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DOE NASA CONTRACTOR REPORT

DOE NASA CR-150578

SUBSYSTEM DESIGN PACKAGE FOR THE ON-SITE MONITOR AT SOLAR HEATING AND COOLING SITES

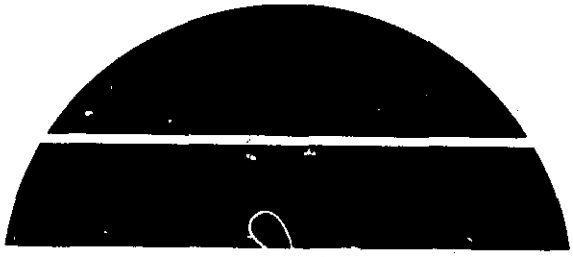
Prepared by

IBM Federal Systems Division
150 Sparkman Drive
Huntsville, Alabama 35805

Under Contract NAS8-32036 with

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

for the U. S. Department of Energy



(NASA-CR-150578) SUBSYSTEM DESIGN PACKAGE FOR THE ON-SITE MONITOR AT SOLAR HEATING AND COOLING SITES (IBM Federal Systems Div.) 19 p HC A02/MF A01 CSCL 10A

N78-20607

Unclas
G3/44 11841

U.S. Department of Energy

Solar Energy

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
DOE/NASA CR-150578		

4. TITLE AND SUBTITLE	5. REPORT DATE
SUBSYSTEM DESIGN PACKAGE FOR THE ON-SITE MONITOR AT SOLAR HEATING AND COOLING SITES	November 1977
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT #
9. PERFORMING ORGANIZATION NAME AND ADDRESS IBM Federal Systems Division 150 Sparkman Drive Huntsville, Alabama 35805	10. WORK UNIT NO.
	11. CONTRACT OR GRANT NO. NAS8-32036
12. SPONSORING AGENCY NAME AND ADDRESS National Aeronautics and Space Administration Washington, D. C. 20546	13. TYPE OF REPORT & PERIOD COVERED Contractor Report
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

This work was done under the technical management of Mr. Cecil V. Messer, George C. Marshall Space Flight Center, Alabama.

16. ABSTRACT

This design package, consisting of the Performance Specification, Performance Requirements Cross Reference, and the Acceptance Test Procedure, reflects the material submitted by IBM on their effort to develop, design and build on-site monitors under NASA/MSFC Contract NAS8-32036.

The on-site monitor is a portable device which can be easily connected to a Site Data Acquisition Subsystem to allow readouts of realtime sensor data in voltage or engineering units at instrumented solar heating and cooling sites.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
	Unclassified-Unlimited William A. Brooksbank, Jr. WILLIAM A. BROOKSBANK, JR. Manager, Solar Heating & Cooling Projects Ofc

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	19	NTIS

MSFC Form 3292 (May 1969)

For sale by National Technical Information Service, Springfield, Virginia 22151

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B

DWG NO. 7934047

REVISIONS

CHK	ENGRG NOTICE	LTR	DESCRIPTION	DATE	APPROVED
	66333SZ	-	RELEASE	7/11/77	
		A	CLARIFICATION OF REQUIREMENTS	7/13/77	
	66348BY	B	IMPLEMENT ADDITIONAL RANGES	10/11/77	J. SLEIGH

CONTR NO. NAS8-32036

PREPARATION B.Moore 7-13-77

DSGN CHK

DWG CHK

DSGR APPROVAL J. Sleigh 7-15-77

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

TITLE ON-SITE MONITOR
DESIGN AND PERFORMANCE
SPECIFICATION

SIZE	CODE IDENT NO.	DWG NO.
A	20234	7934047

SCALE	WT	SHEET 1 of 7

955-1685-0

1. INTRODUCTION

1.1 This specification establishes the design and performance requirements for the On-Site Monitor (OSM). The OSM shall be designed to interface with the Site Data Acquisition Subsystem (SDAS) to allow local readout of sensor data in engineering units stored in the SDAS at instrumented solar heating and cooling sites. The latest revisions to this specification are indicated by line to the right of the changed paragraph.

2. APPLICABLE DOCUMENTS

2.1 The following document forms a part of this specification to the extent specified herein. In case of conflict between this document and the SDAS performance specification, the SDAS performance specification shall govern.

SPECIFICATIONS

Internal Business Machines Corporation

7932905	Site Data Acquisition Subsystem Performance Specification

3. REQUIREMENTS

3.1 General. - The OSM shall be designed to allow manual selection and display of up to three simultaneous SDAS sensor outputs. Operation of the SDAS shall be in accordance with IBM Document 7932905.

3.1.1 OSM/SDAS Isolation. - The OSM shall be designed such that an OSM failure shall not degrade the operation of an SDAS.

3.1.2 Operation. - The OSM shall be designed such that the OSM operator may select the parameter to be displayed from an OSM measurement selection matrix (Table 3-1) which defines the type of measurement, and range (scale factor) in engineering units of measurements programmed in the OSM. Upon manual selection of the measurement(s) to be displayed, the OSM shall obtain raw sensor data in digital format from the SDAS and perform the required calculations to display this data digitally in engineering units. For measurement ranges not preprogrammed into the OSM, the OSM operator will be able to display the digital count value of the measurement and calculate the engineering units using appropriate scale factors for that measurement.

TABLE 3-1. OSM MEASUREMENT SELECTION MATRIX

TYPE	FORMULA	RANGE 0	1	2	3	4	5	6	7	8	9	NOTES
0	TEMPERATURE	-20 120 F	30 160 F	30 230 F	30 450 F							
1	DELTA TEMP	0 50 F	0 80 F	0 100 F								
2	INSOLATION	0 330 BTU	0 350 BTU	0 360 BTU	0 370 BTU	0 380 BTU	0 390 BTU	0 400 BTU	0 410 BTU	0 420 BTU	0 435 BTU	Values given are for 0-12 mv full scale range. Select range to nearest 5 BTU.
3	WIND/HUMIDITY	0 360 DEG	0 100 MPH	0 161 K/H	0 100 %							
4	ELECTRIC PWR	0 .5 KW	0 1 KW	0 1.5 KW	0 3 KW	0 4 KW	0 5 KW	0 10 KW	0 20 KW	0 40 KW	0 160 KW	All values are normalized to 0-50 mv full scale range
5	LIQUID FLOW (0-10 mv Range)	0 3 GPM	0 5 GPM	0 6 GPM	0 7 GPM	0 10 GPM	0 12 GPM	0 15 GPM	0 20 GPM	0 25 GPM	0 30 GPM	All values are for 0-10 mv full scale range.
6	LIQUID FLOW (0-10 mv Range)	0 40 GPM	0 70 GPM	0 100 GPM	0 120 GPM	0 150 GPM	0 175 GPM	0 200 GPM	0 350 GPM	0 600 GPM	0 1000 GPM	
7	LIQUID FLOW (0-30 mv Range)	0 7 GPM	0 10 GPM	0 12 GPM	0 15 GPM	0 20 GPM	0 25 GPM	0 40 GPM	0 70 GPM	0 100 GPM	0 200 GPM	Values given are for 0-30 mv full scale range
8	AIR FLOW	0 300 FPM	0 1250 FPM	0 2.50 KFPM	0 6.00 KFPM							KFPM values given in thousands feet per minute
9	TEST SCALES/ NATURAL GAS	0 100 mv	0 5 V	0 256 CNT	0 1023 CNT	100 MV OFST	5 V OFST	RTC 1-3	RTC 4-6	RTC 7-9		Natural gas engineering unit values must be calculated.

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7934047

3.2 Data Scan. - The OSM shall present an interrupt to the SDAS as a request for data. The software in the SDAS is structured such that this request for a special OSM data scan may not be honored when the SDAS is in its normal data scan mode or is in the communications mode with the Central Data Processing System (CDPS). Therefore, operator requests for the OSM to display data may be delayed until the SDAS software accepts the OSM interrupt request during the OSM operating modes described in paragraph 3.3.

3.3 OSM Modes and Scan Switch. - The OSM shall have two operating modes that are manually selectable by a scan select switch on the OSM display panel. These modes are Manual and Auto. Operation of the scan switch shall be as follows:

Auto Mode. - When the OSM scan switch is placed in the stationary auto position, the OSM shall present the request for data interrupt to the SDAS approximately every two seconds to obtain a complete data set and update the selected data displays at that rate.

Off/Manual. - The OSM scan switch shall also have stationary off/momentary-on positions. When the scan switch is momentarily placed in the manual position, the OSM shall present a request for data interrupt to the SDAS. A complete SDAS sensor data scan shall be requested the data transferred to and retained by the OSM memory for continuous display of the selected parameters. New parameters for display shall be selectable from the data set obtained by this action without re-selecting the manual mode.

3.4 Displays. - The OSM display panel shall have three 3-1/2 digit Light Emitting Diode displays for presentation of SDAS sensor outputs. Associated with each display shall be four ten-position lever wheel switches. Two of the switches shall be used to select the channel to be displayed. One switch shall select the measurement type and one shall select the measurement range (scale factor).

If a channel is selected which is designated a spare at a particular site, the displayed value shall be the value of the corresponding channel digital data words that are stored in the SDAS, noramlly zero. If the channel selected exceeds the number of installed channels in the SDAS or if there is no combination of the measurement

type and scale factor stored in the OSM memory, the selected display shall present -183.8.

3.5 Power Switch. - The OSM shall have a two-position on/off power switch.

3.6 Memory. - The OSM shall contain the 2K byte of Programmable Read Only Memory (PROM) minimum and 1K byte minimum of Random Access Memory (RAM) to perform the functions defined in this specification. The PROM shall be contained in a pluggable subassembly to facilitate bench replacement of the stored measurement and scale factor table and the operational program.

3.7 Microprocessor. - The OSM shall be controlled by a microprocessor similar to that provided in the SDAS.

3.8 Interfaces. -

3.8.1 Power. - Power to the OSM shall be standard 110-125 V, 60 Hertz, 1 Phase, 2.0 amp service. A standard 3-wire power cord (safety ground, power, and return) shall be required. The power cable shall be capable of being stored in the OSM case. All required dc voltages shall be developed internally.

3.8.2 OSM/SDAS Interface Cable. - The OSM/SDAS interface shall be via a 10-ft. maximum cable terminating in a 37-pin pluggable connector. The OSM/SDAS connector shall be designed to interface with the J106 connector on the SDAS. Pin functions shall be as defined in Table 3-2. The OSM/SDAS interface cable shall be capable of being stored in the OSM case.

3.9 Packaging. -

3.9.1 Design Environment. - The OSM shall be designed to operate in an indoor environment suitable for operation by electronic tradesmen.

Table 3-2. OSM/SDAS Pin Functions

PIN NO.	SIGNAL NAME	PIN NO.	SIGNAL NAME
1	UNUSED	30	UNUSED
2	UNUSED	31	UNUSED
3	UNUSED	32	-OSM POWER ON
4	UNUSED	33	SIGNAL RETURN
5	UNUSED	34	UNUSED
6	UNUSED	35	UNUSED
7	UNUSED	36	UNUSED
8	UNUSED	37	UNUSED
9	-OSM CARD SELECT 2		
10	-INTERRUPT POLL		
11	-OSM INTERRUPT REQUEST		
12	-OSM SELECT ACK.		
13	-AI STROBE		
14	FUNCTION BIT 0		
15	FUNCTION BIT 1		
16	UNUSED		
17	UNUSED		
18	UNUSED		
19	UNUSED		
20	UNUSED		
21	UNUSED		
22	SDAS TO OSM DBO BIT 0		
23	1		
24	2		
25	3		
26	4		
27	5		
28	6		
29	7		

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3.9.2 Case. - The OSM shall be contained in a portable case whose dimensions shall be approximately 17" x 17" x 7". The case shall have a carrying handle and a tilt stand.

3.9.3 Weight. - The weight of the OSM, including cables, shall not exceed 40 pounds.

4. DESIGN AND CONSTRUCTION

4.1 Workmanship. - Workmanship in fabrication and assembly of the OSM shall be consistent with good commercial practices.

4.2 Materials and Components. - The OSM shall use commercial grade components.

4.3 Certification. - The OSM shall be UL-certified.

REVISIONS

CHK	ENGRG NOTICE	LTR	DESCRIPTION	DATE	APPROVED
	66333TD	-	RELEASE	7/12/77	
	66333TE	A	REVISION TO CORRECT AND CLARIFY MATRIX	7/19/77	

NOTES

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REV STATUS OF SHEETS

CONTR NO. NAS8-32036

PREPARATION E. A. Moore

DSGN CHK

DWG CHK

DSGN APPROVAL J. Sluish Jr. 7/22/77

OTHER APPROVAL (SPECIFY ACTIVITY)

IBM FEDERAL SYSTEMS DIVISION

☐ GAITHERSBURG, MD ☐ OWEGO, N Y
☐ HUNTSVILLE, AL ☐ MANASSAS, VA

TITLE

ON-SITE MONITOR PERFORMANCE REQUIREMENTS CROSS MATRIX

SIZE	CODE IDENT NO.	DWG NO.
A	20234	7934366

SCALE	WT	SHEET 1 of 3

460H

7934366

This document defines the methods used to verify compliance to the performance requirements of specification 7934047 (On-Site Monitor Design and Performance Specification).

OSM VERIFICATION CROSS MATRIX VERIFICATION METHOD

S = SIMILARITY
A = ANALYSIS
I = INSPECTION
T = TEST

PERFORMANCE REQUIREMENT (IBM SPECIFICATION 7934047)		VERIFICATION PHASE: DEVELOPMENT TEST	VERIFICATION PHASE: ACCEPTANCE TEST
3.0	REQUIREMENTS		
3.1	GENERAL	A	
3.1.1	OSM/SDAS ISOLATION	A	
3.1.2	OPERATION	T	T
3.2	DATA SCAN	T	T
3.3	OSM MODES AND SCAN SWITCH	T	T
3.4	DISPLAYS	T	T
3.5	POWER SWITCH	T	
3.6	MEMORY	A	
3.7	MICROPROCESSOR	I	
3.8	INTERFACES		
3.8.1	POWER	T	
3.8.2	OSM/SDAS INTERFACE CABLE	T	
3.9	PACKAGING		
3.9.1	DESIGN ENVIRONMENT	T	
3.9.2	CASE	A,I	
3.9.3	WEIGHT	T	
4.0	DESIGN AND CONSTRUCTION		
4.1	WORKMANSHIP		
4.2	MATERIALS AND COMPONENTS	A	
4.3	UL CERTIFICATION	A,I,T	

OSM

DWG NO. 7934067

D

REVISIONS

CHK	ENGRG NOTICE	LTR	DESCRIPTION	DATE	APPROVED
		A	RELEASE	3/3/77	
		B	Revision to correct typographical errors in Table 1	5/25/77	
	66333ZS	C	Revision to clarify Table 1	6/24/77	
	66348BY	D	Implement Additional Ranges	10/11/77	J. Sleigh

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CONTR NO. NAS8-32036

PREPARATION J. A. Barber

DSGN CHK

DWG CHK

DSGN APPROVAL J. D. Plunkett

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

TITLE
On Site Monitor (OSM) Acceptance Test Procedure

SIZE	CODE IDENT NO.	DWG NO.
A	20234	7934067

SCALE	WT	SHEET 1 of 7

955-1685-0

1.0 SCOPE

1.1 GENERAL

This procedure defines the test conditions and required performance for the On Site Monitor (OSM). The latest revisions to this procedure are indicated by a line to the right of the changed paragraph.

1.2 PURPOSE

This test has been developed to perform the final operational test of the On Site Monitor using its interface through the Site Data Acquisition Subsystem (SDAS). The test will verify the unit operability utilizing the field microcode processor. Attendant to this configuration will be a SDAS with straight-through microboards to accept test voltage inputs. The validation of unit performance will be in accordance with the OSM performance specification.

2.0 APPLICABLE DOCUMENTS

7934047 On Site Monitor Design and Performance Specification

3.0 REQUIREMENT

3.1 PRIOR COMPLIANCE

Prior to subjecting the OSM to the tests specified herein, the OSM will have successfully met the requirements of manufacturing tests and inspections.

4.0 TEST CONFIGURATION

The test configurations (as illustrated in Figure 1) has the necessary stimulus equipment to fulfill the needs of the performance specification.

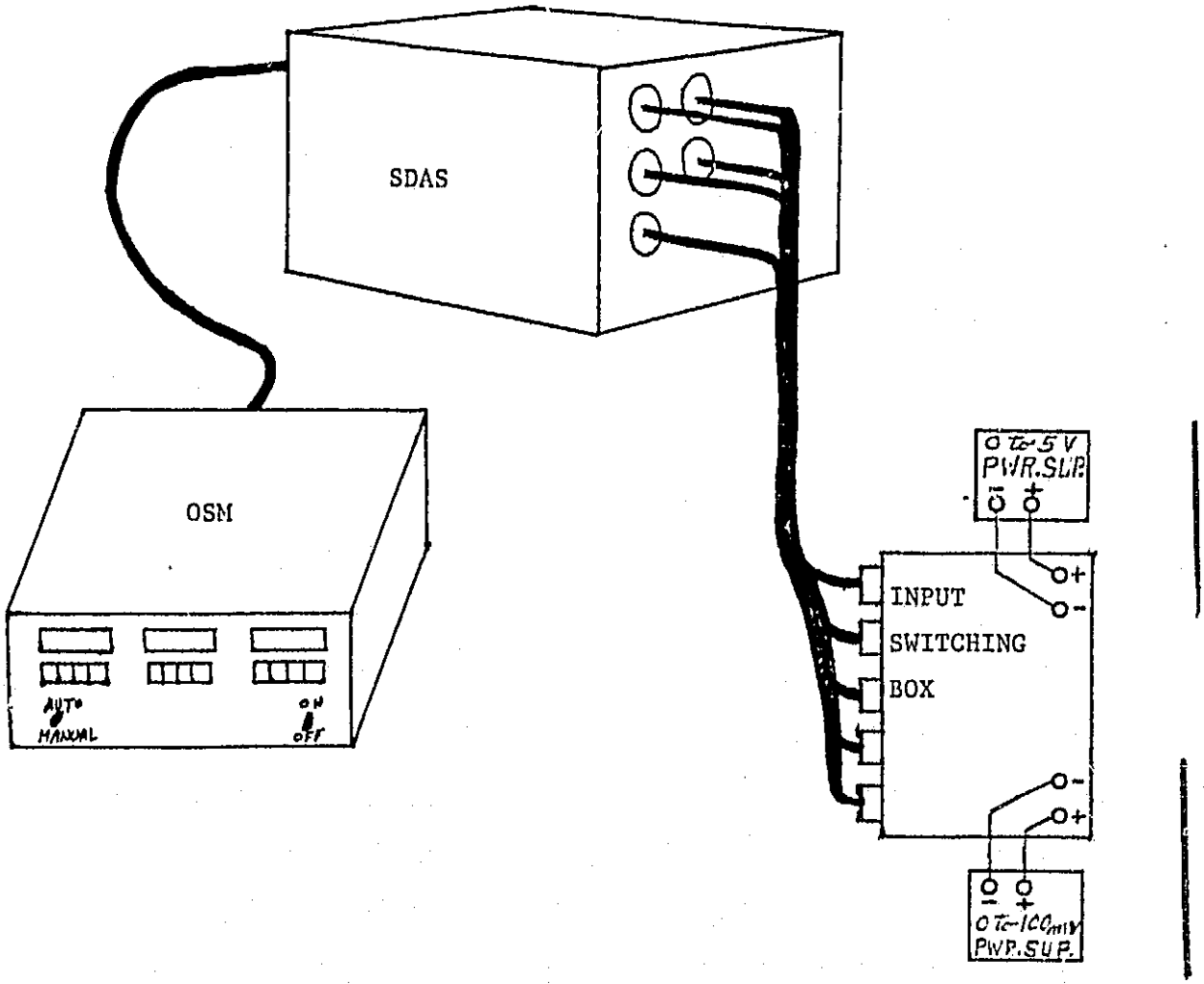

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FIGURE 1. ACCEPTANCE TEST CONFIGURATION

5.0 OSM TEST

5.1 This section describes the test setup for the OSM/SDAS functional test.

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

5.1.2 Connect the OSM to the SDAS (J106) using the OSM interface cable connector.

5.1.3 Adjust the SDAS analog input 5 VDC power supply to 2.5 VDC and the 100 MVDC power supply to 50 MVDC. Set the channel selector switches on the input switching box to select voltage inputs corresponding to those specified in the performance specification for the SDAS being used in the test configuration. It is important to know which SDAS channels are programmed for 5 volts full range and which are programmed for 100 mv full range.

5.1.4 Connect the SDAS prime power line to the convenience outlet (110 VAC).

5.1.5 Connect the OSM prime power line to the convenience outlet (110 VAC).

5.1.6 Turn the main power switch on the SDAS to the "ON" position.

5.2 DATA DISPLAY

Turn the main power switch on the OSM under test to the "ON" position.

5.2.1 Select 0096, 0097, and 0098 with the "Channel,Type,Range" switches for displays 1, 2, and 3 respectively. (Displays are numbered from left to right.) These switch positions select the three bytes of the real time clock.

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5.2.2 Depress the "SCAN" switch to the "MANUAL" position. Observe that values are displayed with no decimal points.

5.2.3 Put the "SCAN" switch to the "AUTO" position and observe that display 3 increments by 1 approximately every two seconds. If the SDAS is writing to tape the display will not update for approximately 10 seconds. When the display is updated, it will be incremented by approximately 5 counts and then will continue to increment by counts of 1.

5.2.4 Select display 1 to a channel with a 50 MVDC input. Select "Type, Range" switches to 90 respectively. Observe that approximately 50.0 is displayed. Adjust the DC input until a 50.0 display value is obtained. Step through the selector switch settings as indicated in Table 1 observing that the nominal display value as shown in Table 1 is displayed.

6.0 TEST FAILURE

Any error in the data display will be considered a test failure.

7.0 TEST COMPLETION

7.1 Turn the power switch on the OSM unit under test to the "OFF" position.

7.1.1 Disconnect the OSM prime power cord (110 VAC) from the convenience outlet and secure the cord.

7.1.2 Turn the power switch on the SDAS to the "OFF" position.

7.2 Disconnect the OSM interface cable from the SDAS and secure the cable.

Table 1. Engineering Unit Conversion Test

SELECTOR SETTING	NOMINAL DISPLAY UNIT
* XX93	512
XX90	50.0
XX00	50.2
XX01	95.2
XX02	130
XX03	240
XX10	25.0
XX11	40.0
XX12	50.0
XX33	50.0
* XX93	256
XX90	25.0
XX40	.250
XX41	.500
XX42	.750
XX43	1.50
XX46	5.00
XX47	10.0
XX49	80.0
* XX93	079
XX90	07.7
XX70	03.5
XX71	05.0
XX74	10.0
XX76	20.1
XX78	50.2
* XX93	061
XX90	06.0
XX20	164
XX21	174
XX26	198
XX29	216
* XX93	051
XX90	05.0
XX56	10.5
XX59	21.0
XX60	28.0
XX64	105
XX69	699
* AA93	512
AA92	128
AA91	2.50
AA30	180
AA31	50.0
AA32	80.6
AA80	063
AA81	258
AA82	0.42
AA83	0.83

* - Indicates that the DC input supply should be adjusted to obtain the nominal display value.
XX - Denotes any 100 mv channel.
AA - Denotes any 5 v channel.

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7.2.1 Disconnect the SDAS prime power cord (110 VAC) from the convenience outlet.

7.2.2 Disconnect the dc input power line from the analog input switching box.

7.2.3 Disconnect all cables from the SDAS.

7.3 Return the OSM unit to stock.

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