SOFT X-RAY TELESCOPE (SXT) FOR SOLAR - A EXPERIMENT INTERFACE CONTROL AGREEMENT

CONTRACT NO. NAS8-37334

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Version 10
Flight Model

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Document: SXT8E022

SOFT X-RAY TELESCOPE (SXT) FOR SOLAR - A EXPERIMENT INTERFACE CONTROL AGREEMENT

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EICA Versions

See Appendix A for a complete description of the procedure to make changes to the EICA, and the changes that have been made.

Date	Release	U-side Version	J-side Version	Contact
24-Oct-87	A			L.W. Acton
30-Oct-87	A			"
10-Nov-87	A			"
13-Nov-87	A			M.E. Morrill
19-Nov-87	B			M.E. Morrill
1-July-88		2.01		M.D. Morrison
17-Dec-86			1	
13-Nov-87			2	
24-Nov-87			3	
2-Sept-88		2.02		Z. Peri
06-Oct-88			4	
15-Nov-88		5	5	Z. Peri
30-Nov-88		6	6	Z. Peri
06-Feb-89		7	7	Z. Peri
07-Sep-89		8	8	Z. Peri
13-Oct-89		8	9	Z. Peri
24-Sep-90		10	10	M. L. Finch

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Reference is to section where each table first occurs.

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CHAPTER 1

GENERAL

1.1 Scope -

This document defines the interfaces between the MSFC/LPARL and the ISAS/NAOJ/IAUT for the SXT experiment. It covers the physical, functional and operational interfaces between the components of the SXT experiment and the SOLAR-A spacecraft and launch vehicle. It is intended to serve as the definitive EXPERIMENT INTERFACE CONTROL AGREEMENT.

1.1.1 Maintenance Of EICA Document -

Appendix A describes the procedure for maintaining the EICA. Appendix A also contains a table which lists the changes that have been made over time to the EICA. Changes and proposed revisions will require mutual agreement by both US and Japanese sides.

The EICA will be maintained by the U.S. side. Major design meetings shall occur approximately every 6 months. A formal release of the document will occur with a goal of one months after the meeting.

1.2 Experiment Block Diagram -

The experiment block diagram is presented in Figure 1.2-1 [SXT-2E037].

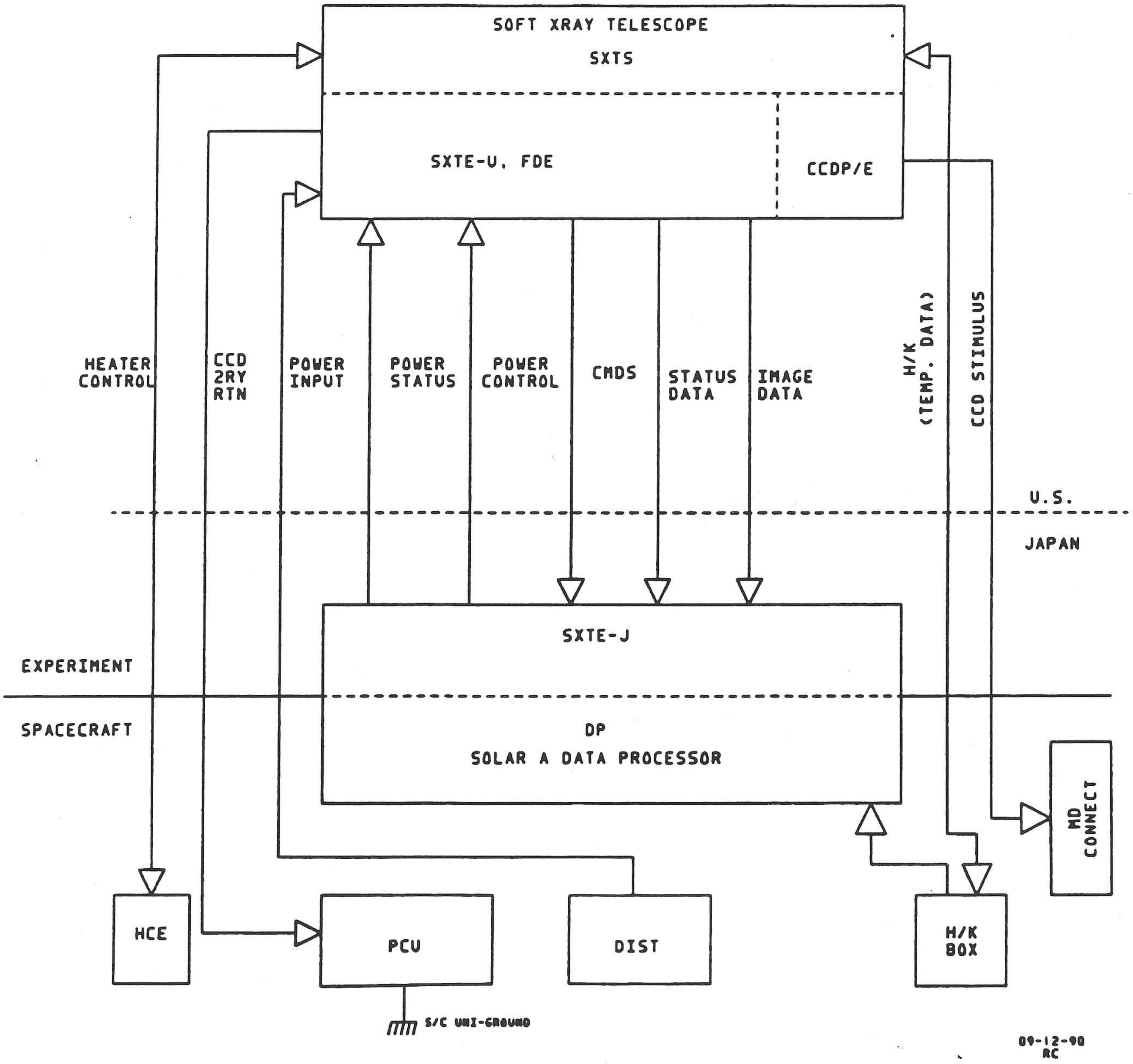


Figure 1.2-1 [SXT-2E037] EXPERIMENT INTERFACE BLOCK DIAGRAM

1.2.1 SXT Interface Definition -

The following diagram is a schematic representation of the interfaces between the US and Japanese portions of the SXT program.

```
       US provided portion                     J provided portion

-------
|  |--- FDE     <--M/T----------------------M/T--->  Spacecraft
|  E                    |                  --A---->
|  |                    |                  |
|  |---         ---A----|------------------|
|       SXTS    <--M/T--|
|  |---         ---E-------------------------E---->   HK
|  |            ---E-------------------------E---->   HCE
|  E                    |
|  |---                 |
E
|       CCDE/P  <--M/T--|                  ---E---->  DP/SXTE-J
|  |---                 |                  |           |
|  E                    |                  |           E
|  |---         <--M/T--|                  |           |
|                                          |          TCU
|------ SXTE-U  <--E------------------------
                <--E--------------------------E-----  JNC
```

M: Mechanical interface
T: Thermal interface
E: Electronic interface
A: Alignment

1.3 Abbreviations And Acronyms -

Sub-elements are listed under the specific units or systems of which they are a part.

Table 1.3-1
Abbreviations and Acronyms

SXTS	SXT Instrument system
OG	Objective Group
XRMA	X Ray Mirror Assembly
EFA	Entrance Filter Assembly
ATA	Aspect Telescope Assembly
ATD	Aspect Telescope Door
MTG	Metering Tube Group
FSPM	Forward Support Plate Mount
ASPM	Aft Support Plate Mount
MT	Metering Tube
FPG	Focal Plane Group
TSA	Thermal Strap Assembly
FWA	Filter Wheel - Front
FWB	Filter Wheel - Rear
CCDH	CCD Camera Head
TEC	Thermo-Electric Cooler
TS	Thermal Shunt
CCDS	CCD Spacer/Contamination Slide
SHA	Shutter Assembly
SM	Shutter Motor
SXTE-J	SXT Electronics in DP: Japanese provided
SXTE-U	SXT Electronics Box: US provided
PEB	Processor electronics box
SDE	Shutter Drive Electronics
PDU	Power Distribution Unit
CCDE/P	CCD Electronics Box/CCD Power Supply Box
DSP	Double Sampling Processor
SPE	Sub-Pixel Electronics
PCU	Power Converter Unit
LTIE	Line Timing & Interface Electronics
FDE	Filter Wheel Drive Electronics
ADE	Aspect Drive Electronics
MLI	Multi-Layer Insulation
PCM	Pulse Code Modulation
DP	SOLAR-A Data Processor
CBL-U	Cable Harness: US provided
TCU	Telemetry Command Unit
HK	House Keeping Box
ECE	Electrical Checkout Equipment
DSTS	Data System Test Set
CSTS	Camera System Test Set
GSE	Ground Support Equipment
DJAF	Drill Jig/Alignment Fixture
LFA	Lifting Fixture Assembly
COMMANDS	
DC	Discrete Command
BC	Block Command

1.4 SXT Exposure And Filter Information -

Appendix C describes the various SXT filters and shows a table of the various effective exposure times which can be commanded.

This page is to insure that the next chapter starts on an odd page.****

CHAPTER 2

STRUCTURAL/MECHANICAL

2.1 SXT Layout And Coordinate System -

The overall layout of the SXT experiment within the SOLAR-A spacecraft is indicated schematically in Figure 2.1-1 [SXT-26019]. The SOLAR-A coordinate system is a right-handed orthogonal system with the +Z axis directed towards the sun, parallel to the SXT optical axis. The +X axis is parallel to the mounting plane of the SXTS portion of the SXT instrument which is on the -Y side of this plane. In orbit the +Y axis is directed towards ecliptic north.

2.1.1 Cable Layout Requirements -

Maximum harness length: between CCDE and SXTS
spec.: 68.6 cm (27 in) for long cable
53.4 cm (21 in) for short cable

CCDE should be located on top of CCDP. The harness connecting CCDP to SXTE-U contains a high speed (131072 Hz) image data cable.
For CCD cable layout between CCDH and CCDE/P see Figure 2.3-2.

2.1.2 SXTS FOV Clearance -

SXT FOV clearance is a region with cone angle of 10 degree around SXTS optical axis. This cone region for the clearance must not be obstructed by any portion of the spacecraft (antennas etc.).

2.2 SXTS Envelope -

The SXT instrument is to be accommodated within an envelope of 30x30x170 cm. SXT electronics boxes may be accommodated outside of this volume. Projection of the SXT instrument outside of this volume must be approved by the Japanese side. Projection of other SOLAR-A equipment into this volume must be approved by the U.S. side.

The clearance between the front of SXTS aperature plate and the spacecraft top panel is 10 mm minimum (see Figure 2.2-1). The spacecraft close-out opening without sun-shade is 26 cm in diameter,and SXT protective cover should be designed for removal through the opening.

See SXTS envelope drawing Figure 2.2-2.

For TSA bulkhead capture block see Figure 3.3-4.

Lockheed

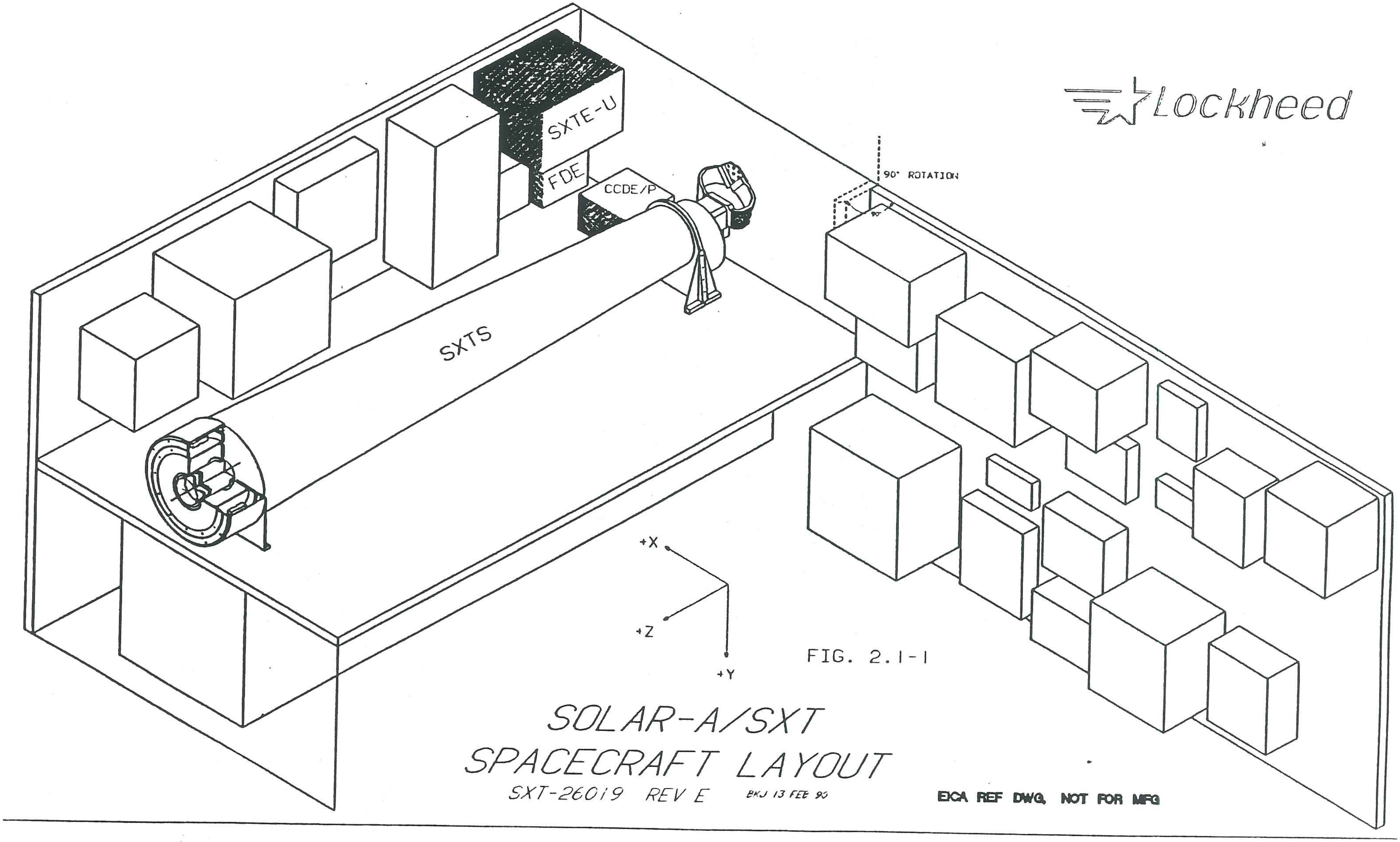
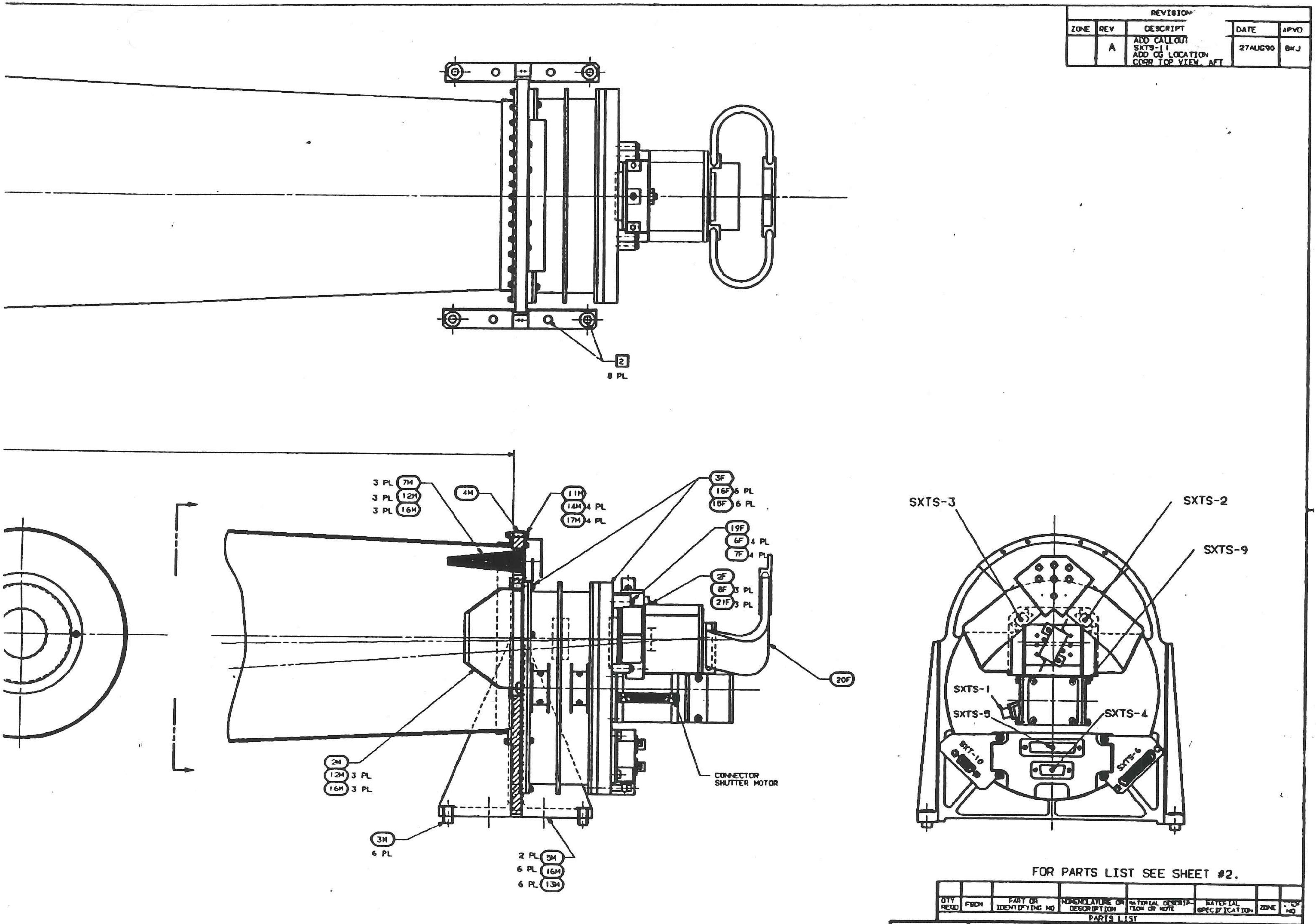


FIG. 2.1-1

SOLAR-A/SXT
SPACECRAFT LAYOUT
SXT-26019 REV E BKJ 13 FEB 90

EICA REF DWG, NOT FOR MFG



REVISION				
ZONE	REV	DESCRIPT	DATE	APVD
	A	ADD CALLOUT SXTS-11 ADD CG LOCATION CORR TOP VIEW, AFT	27AUG90	BKJ

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	NO

PARTS LIST

OLD DRAWING #
SXT-20000 REV C

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES TOLERANCES ON:
FRACTIONS ± 1/16
DECIMALS .X ± .03
.XX ± .010
.XXX ± .005
ANGLES ± 0° 30 MIN

SOLAR-A
NEXT ASSY | USED ON
APPLICATION

CONTR NAS5-37334
DCA/CI

DATE 90-01-25
DWN B.K.JURCEVICH
APVD J.R.VIEIRA
APVD M.F.BRUNER
ENGRG B.K.JURCEVICH
CHKR J.R.VIEIRA
APVD G.GRADWOHL
APVD M.FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

SOLAR-A/SXT
TOP ASSEMBLY

SIZE E | FSCM 65113 | DRAWING NO SXT-2M003 | REV A
SCALE 1/1 | SH 1 OF 2

Figure 2.1-2A (SXT-2M003) Solar-A/SXT Top Assembly, Sheet A

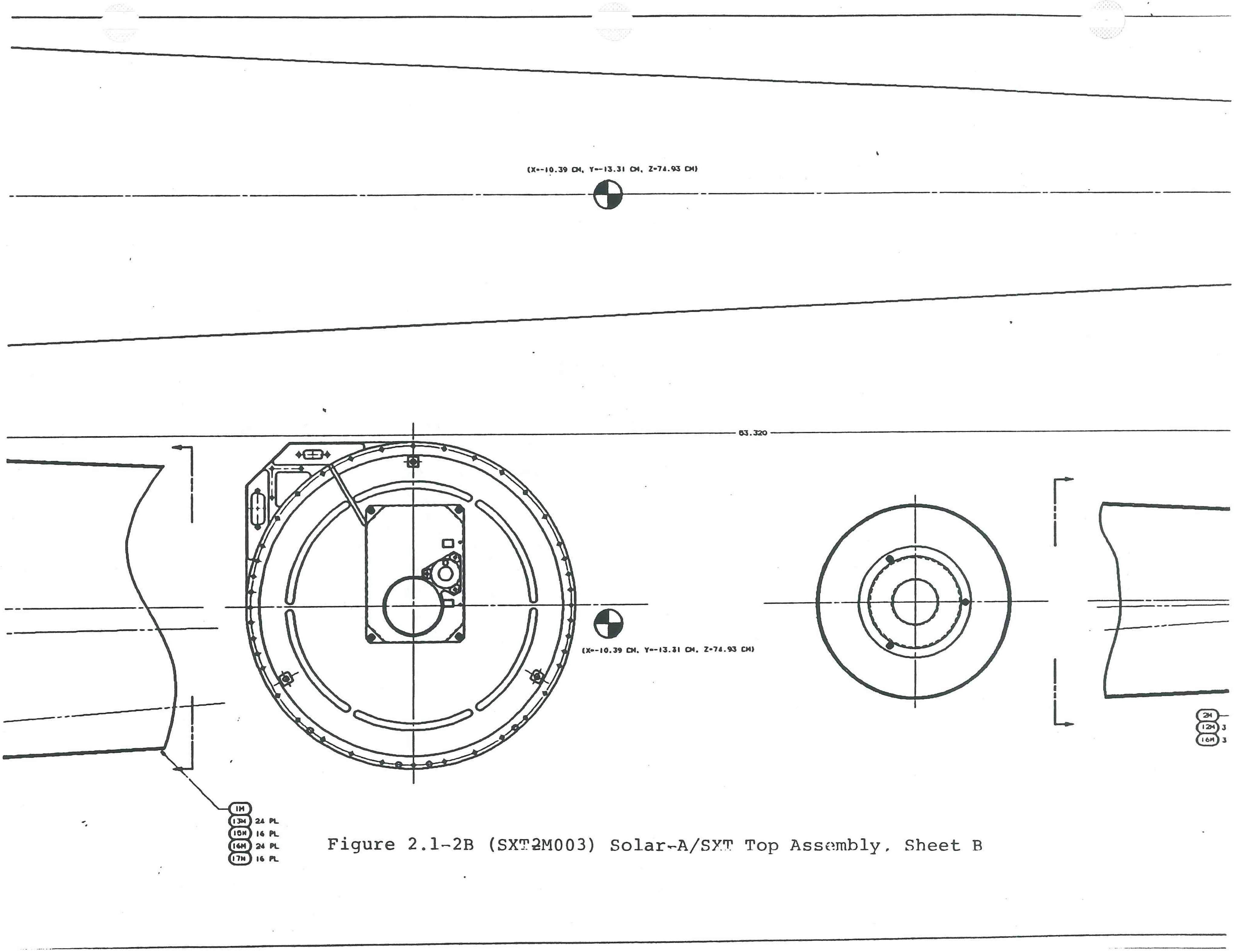


Figure 2.1-2B (SXT2M003) Solar-A/SXT Top Assembly, Sheet B

NOTES: (U[illegible]S OTHERWISE NOTED)

1. TORQUE [illegible]RS PER LAC 3600.

2. MOUNTING HOLES DRILLED USING DRILL TEMPLATE SXT-20010. SEE METERING TUBE ASSEMBLY SXT-20011 FOR DETAILS. (10 HOLES TOTAL)

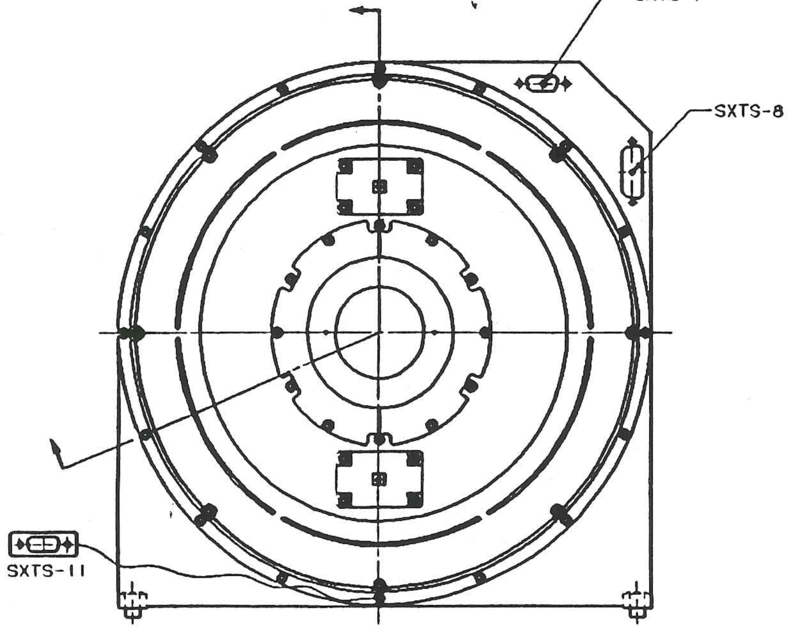
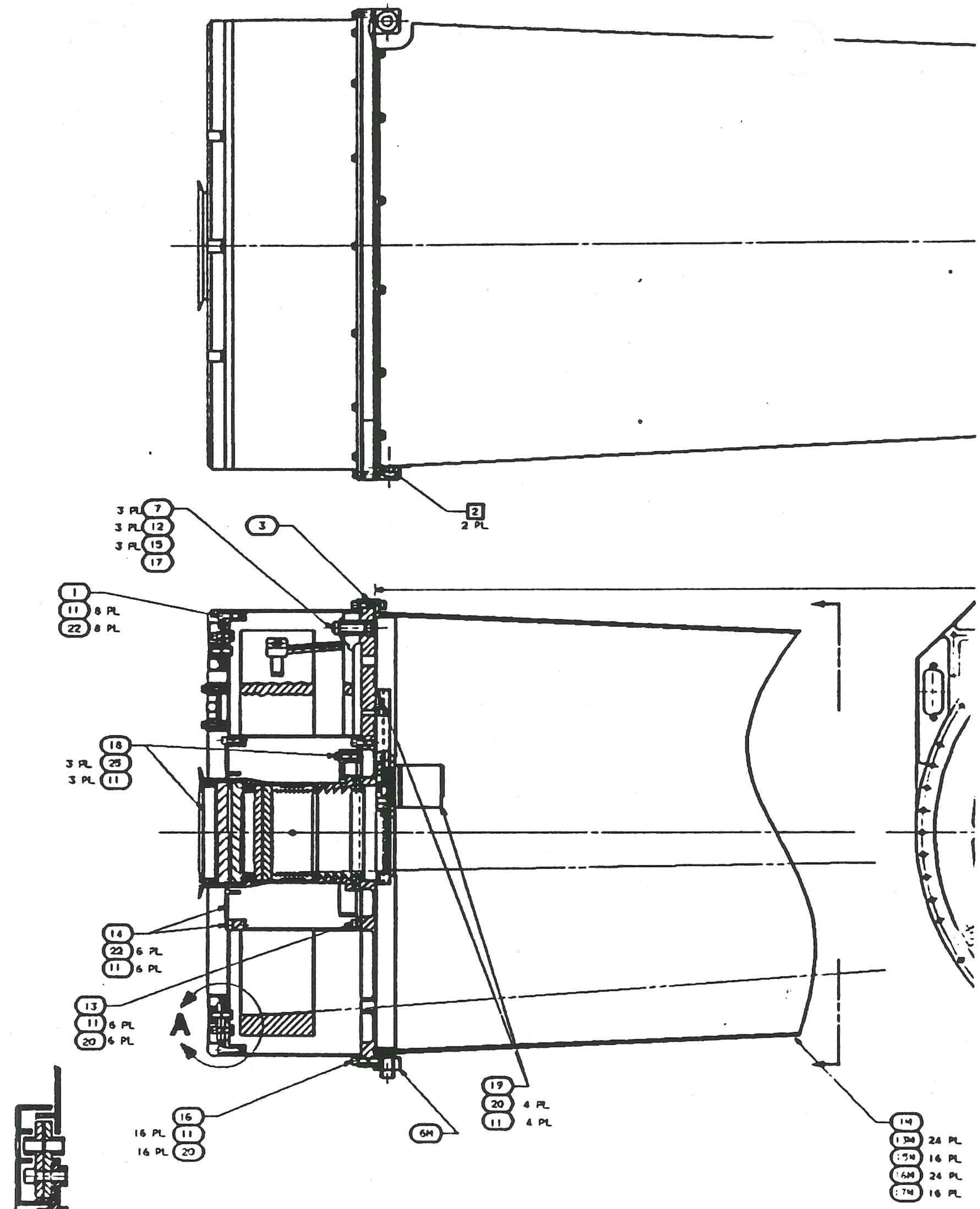


Figure 2 1-2C (SXT-2M003)



Solar A/SXT Top Assembly Sheet C

SOLAR-A/SXT
INSTRUMENT ASSEMBLY

SXT-20015 REV E BKJ 13 FEB 90

SOME PARTS OMITTED FOR CLARITY

BCA REF DWG. NOT FOR MFG

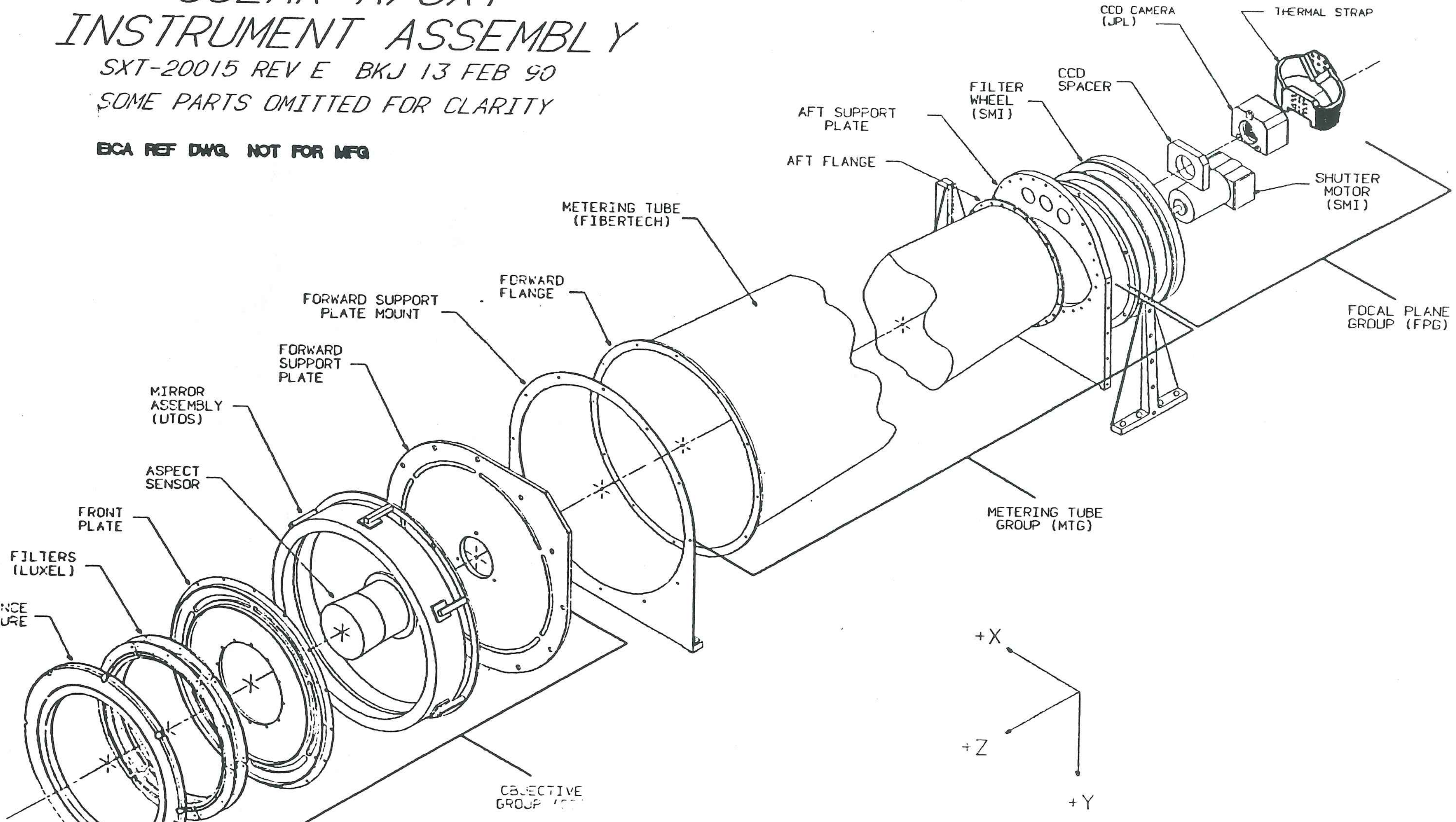
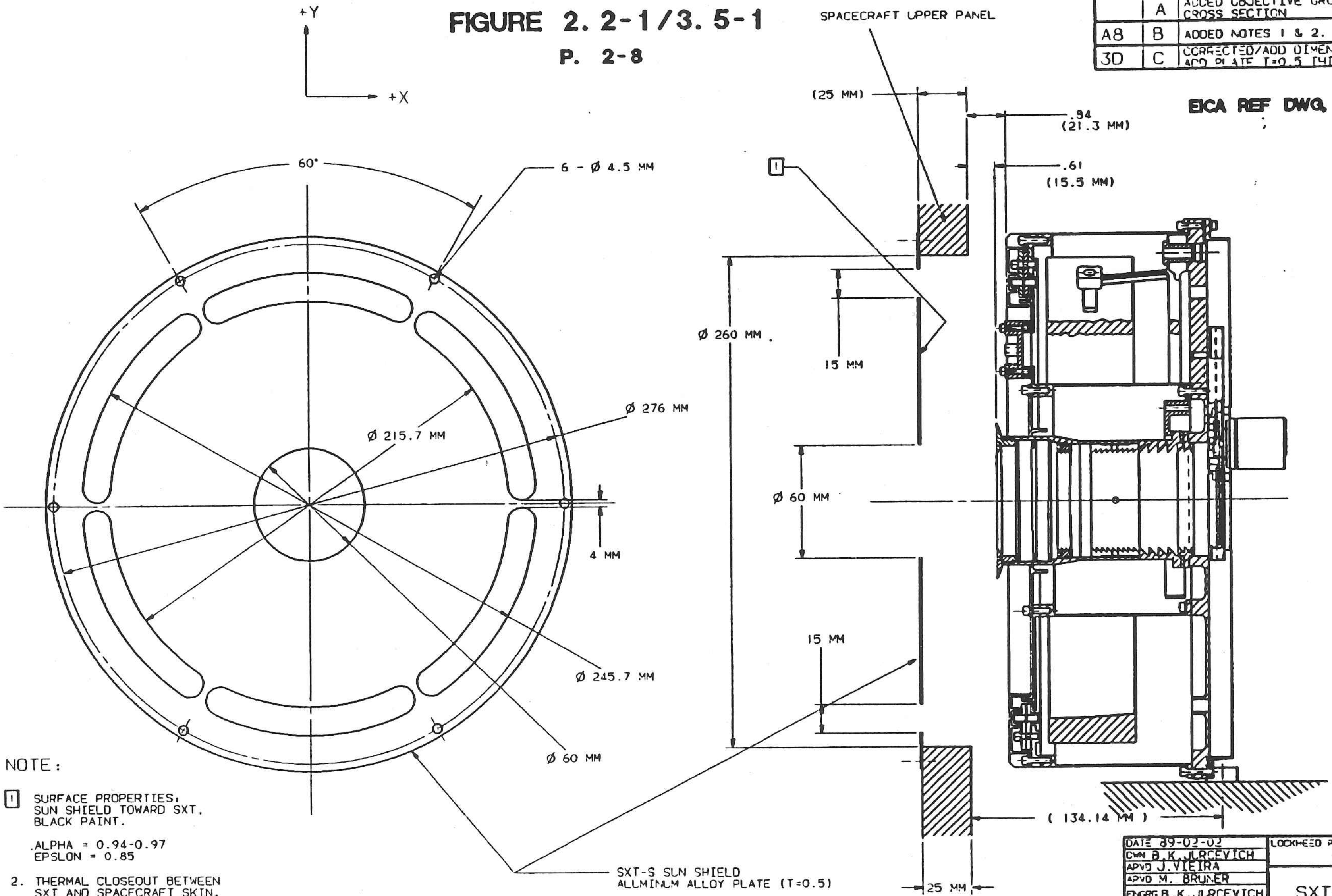


FIGURE 2.2-1/3.5-1
P. 2-8

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
	A	ADDED OBJECTIVE GROUP CROSS SECTION	89-7-12	KFG BKJ
A8	B	ADDED NOTES 1 & 2.	90-5-21	KFG
3D	C	CORRECTED/ADD DIMENSIONS ADD PLATE T=0.5 THICK	90-8-29	BKJ

EICA REF DWG, NOT FOR MFG



NOTE:

1. SURFACE PROPERTIES; SUN SHIELD TOWARD SXT. BLACK PAINT.

   ALPHA = 0.94-0.97
   EPSLON = 0.85

2. THERMAL CLOSEOUT BETWEEN SXT AND SPACECRAFT SKIN. (NEC SUPPLIED)

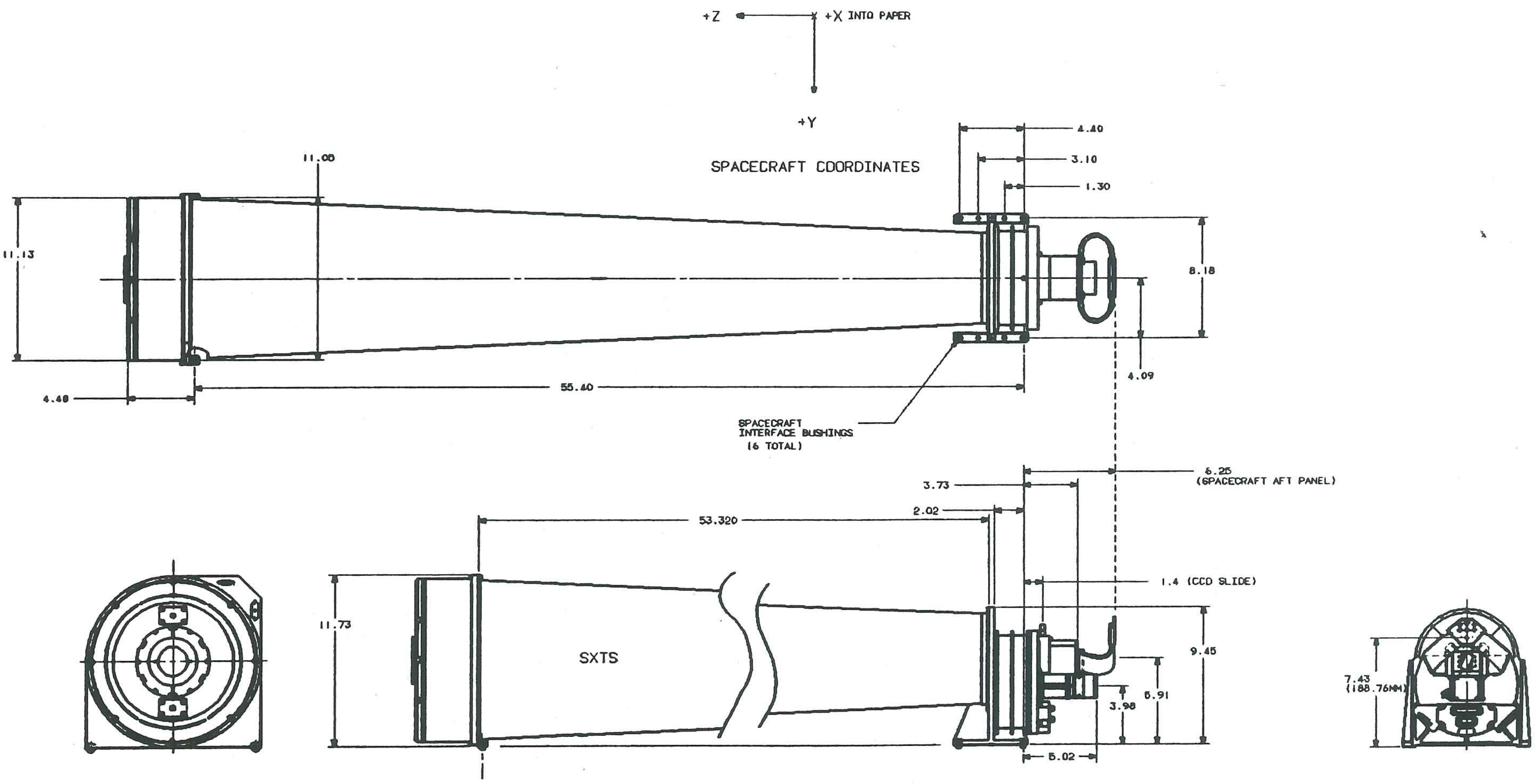
DATE 89-02-02
DWN B.K. JURCEVICH
APVD J. VIEIRA
APVD M. BRUNER
ENGRG B.K. JURCEVICH
CHKR J. VIEIRA
APVD M. FINCH
APVD G. GRACWOHL

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

SXT-S SUN SHIELD

SIZE D
FSCM 65113
DRAWING NO SXT-2A029
REV C
SCALE 1/1

ZONE	REV	DES[illegible]ON	DATE	APVD
	A	GENERAL UPDATE ADDED NOTE 1.	2/16/90	BKJ



NOTES:

1. DIMENSIONS ARE TO ACTUAL HARDWARE. MLI BLANKET MAY EXCEED THIS ENVELOPE. FOR MLI DRAWING SEE SXT-2M004.

EICA REF DWG, NOT FOR MFG

FIGURE 2.2-2

2M003	SOLAR-A	CONTR NAS8-37334	APVD M. FINCH
NEXT ASSY	USED ON		

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG,30 MIN

DATE 88-07-15
DWN B.K.JURCEVICH
APVD M. BRUNER
APVD J. VIEIRA
ENGRG B.K.JURCEVICH
CHKR J. VIEIRA
APVD G.GRADWOHL

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PALO ALTO, CALIFORNIA

SXTS -- FLIGHT MODEL
FLIGHT MODEL
ENVELOPE DWG

SIZE	FSCM	DRAWING NO	REV
E	65113	SXT-2M001	A

2.3 Mass Properties -

2.3.1 Mass -

The initial design mass for the SXT instrument and electronics boxes will be determined and listed in Table 2.3-1. As the individual components or subsystems are fabricated and/or modified the revised mass for each shall be entered in Table 2.3-1 along with the date.

Table 2.3-1
SXT Component Mass

Component or Subsystem	Mass (kg)						
Date=>	9/87	5/88	9/88	1/89	9/89	4/90	dddd
SXTS	17.4#	14.5	13.74		13.105	14.681	
TSA	---	0.5	0.5		0.5	*	
CCDE/P	1.7	1.7	1.7	2.173	1.901	2.110	
FDE	1.8	2.6	1.77		1.85	1.902	
SXTE-U	6.0	6.0	6.0		6.0	5.088	
CBL-U	0.9	0.9	0.9		0.9	*	
MLI	1.0	0.6	0.53		0.5	*	
Total	28.8	26.8	25.14	25.613	24.756	23.781	

NOTE:
For Structural Model information see appendix H.
* included in SXTS

2.3.2 Centers Of Mass -

The centers of mass of the SXT instrument and the electronics boxes are given in Table 2.3-2 in terms of a right-handed coordinate system defined with respect to an u1,u2 plane which is coincident with the mounting plane of each component. The origin of each coordinate system is centered on a mounting hole as shown in Figure 2.3-1 [SXT-20002] and 2.3-1A SXTS coordinate system origins detail. The electronics boxes have been assumed to be homogeneous for the purpose of calculating their center of mass.

Table 2.3-2
SXT Centers of Mass (cm)

COMPONENT	u1	u2	u3 (cm)
SXTS w/TSA	69.58 (+- 0.5)	10.39 (+- 0.5)	13.14 (+- 0.5)
CCDE/P	6.86 (+- 0.04)	6.86 (+- 0.04)	5.13 (+- 0.04)
FDE	9.14 (+- 0.5)	6.35 (+- 0.5)	5.42 (+- 0.5)
SXTE-U	13.34 (+- 0.5)	7.40 (+- 0.5)	11.23 (+- 0.5)

2.3.3 Moments Of Inertia -

The moments of inertia (MOI) listed in Table 2.3-3 have been calculated for the three principal axes for the SXT instrument and each electronics box. These calculations assume that the units are homogeneous and that the three principal axes (u1', u2', u3')pass through the center of mass of each and are parallel to the u1, u2 and u3 axes shown in Figure 2.3-1 [SXT-20002].

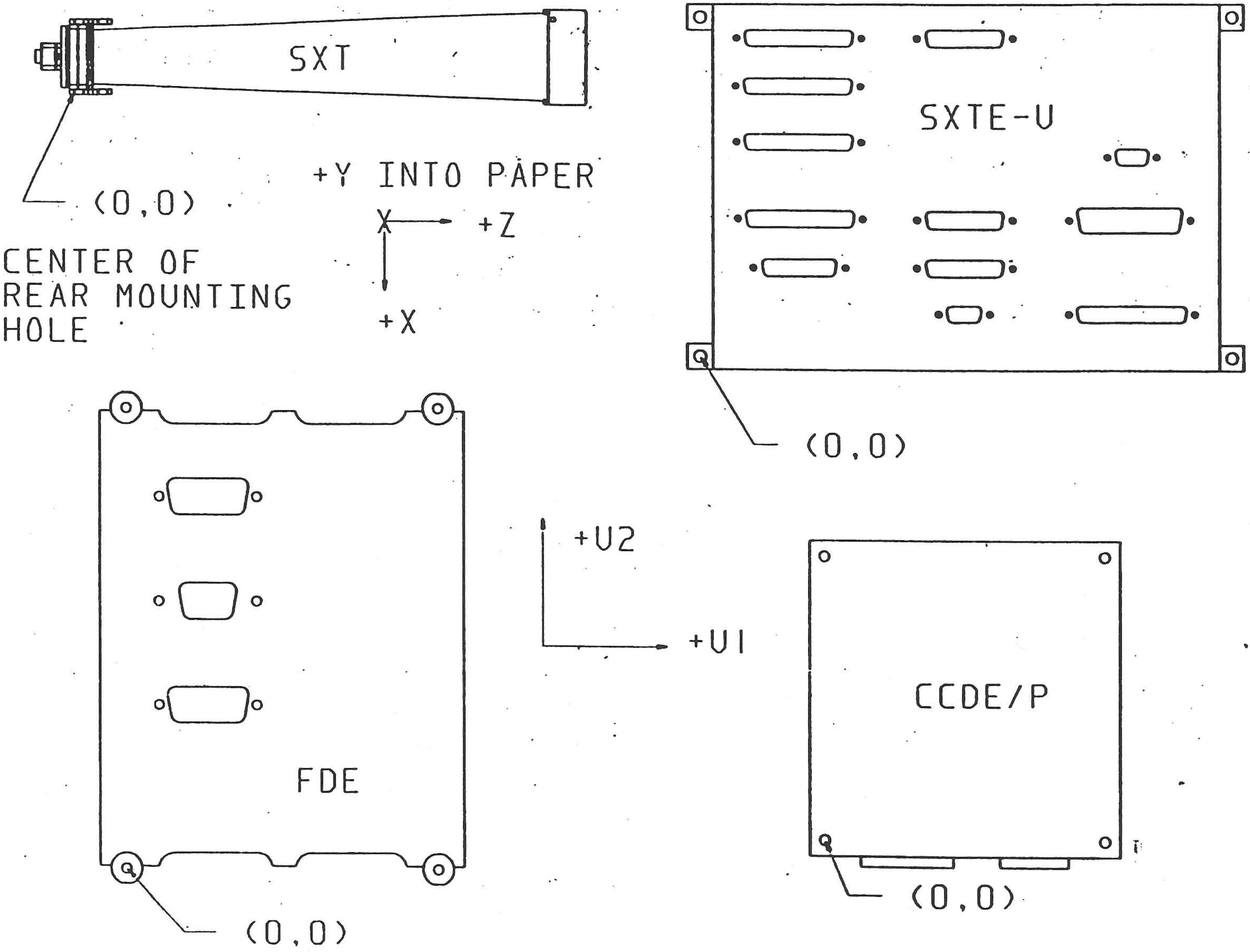
Table 2.3-3
SXT Moments of Inertia

			MOI (kg m^2)
COMPONENT	Iu1'	Iu2'	Iu3'
SXTS #	1.449	6.88	6.87
CCDE/P	.00571	.00571	.00817
FDE	.00517	.00682	.00869
SXTE-U	.03112	.04752	.03830

Note:

Does not include MLI or CBL-U, but does include TSA in calculation. Since the MLI is relatively uniform over the SXTS, and the mass of the cables is small, the effect of these items on MOI should be very small.

EICA REF DWG, NOT FOR MFG

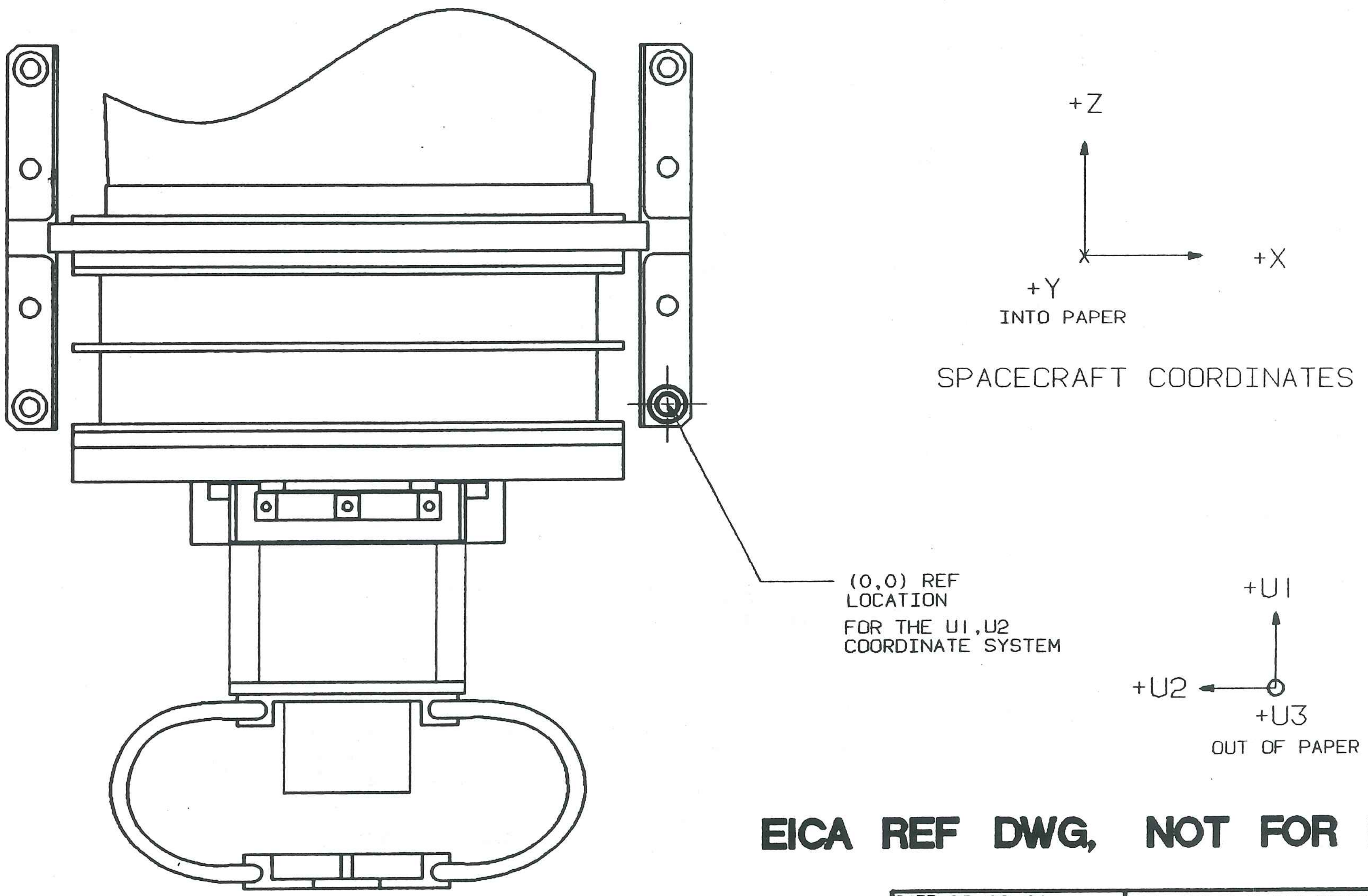


ORIGINS OF COORDINATES FOR CENTERS OF MASS
AND MOMENTS OF INERTIA

SXT-20002

ICA FIG. 2.3-1)

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
	A	ADDED EICA REF NOTE. NAMES TO SIG BLK	2/15/90	BKJ



TOP VIEW OF SXTS

EICA REF DWG, NOT FOR MFG

FIGURE 2. 3-1 A

DATE 89-02-01	LOCKHEED PALO ALTO RESEARCH LABORATORIES PALO ALTO, CALIFORNIA
DWN B.K.JURCEVICH	
APVD J.R.VIEIRA	SXTS (0,0) REFERANCE LOCATION SOLAR-A/SXT
APVD M.E.BRUNER	
ENGRG B.K.JURCEVICH	
CHKR J.R.VIEIRA	
APVD G.GRADWOHL	SIZE C FSCM 65113 DRAWING NO SXT-40080 REV A
APVD M. FINCH	SCALE NONE SH 1 OF 1

ZONE	REV	DESCRIPTION	DATE	APVD
	-	NEW DIMENSIONS [illegible] ED NEW NUMBER 25[illegible] 02A	89/2/8	BKJ
	A	ADD GROUNDING [illegible] CONNECTOR NUM[illegible]	89/2/20	BKJ
	C	ADDED RADIATION [illegible] CHANGED GROUNDING STRAP LOCATION REVERSED SXTS-4 & SXTS-5 ADD SXTS-1, SXTS-6 & SXTS-9	89-7-11	KFG
	D	UPDATE, CABLE AND GROUND	23APR90	BKJ

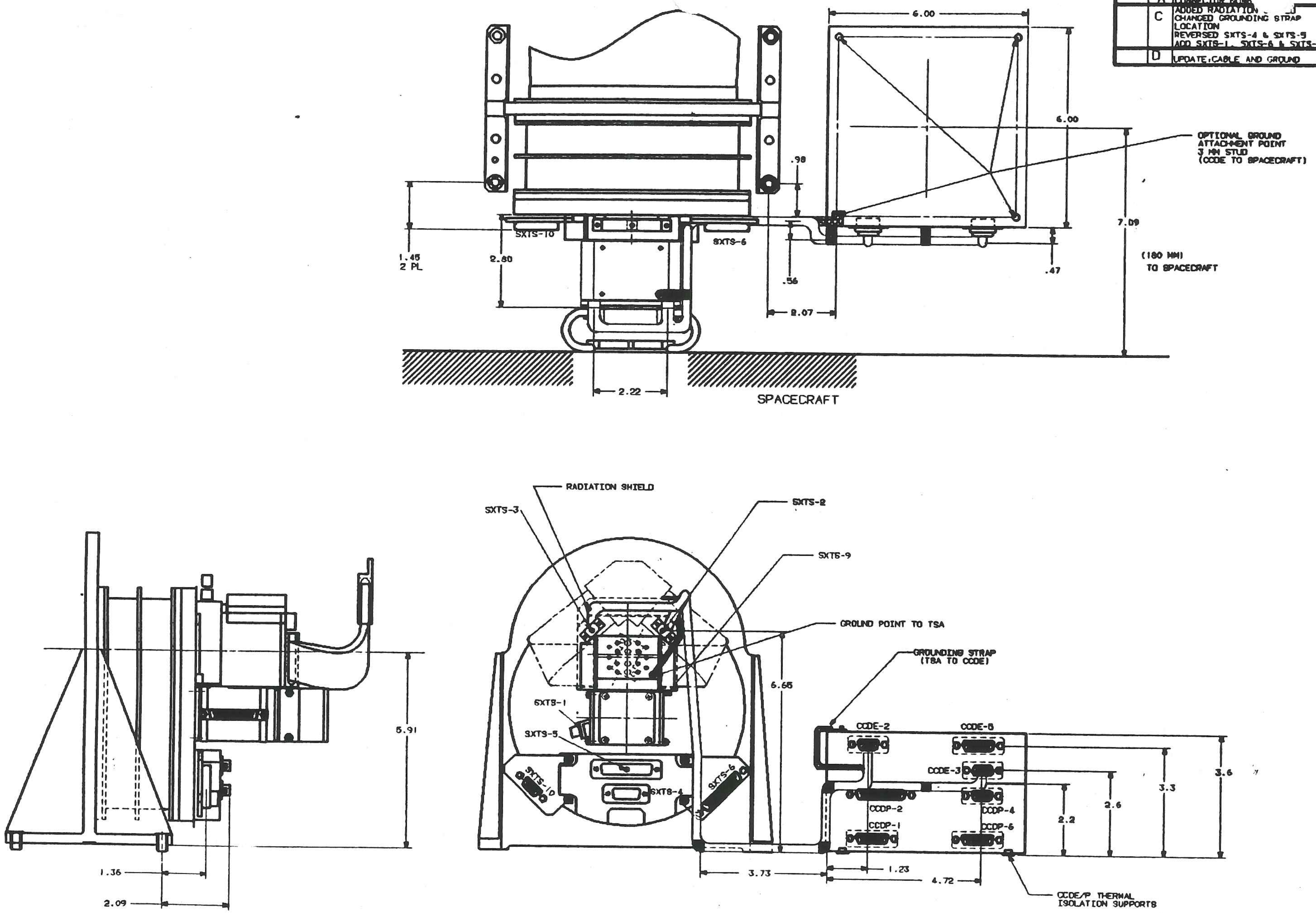


FIGURE 2.3-2

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: X = ± .05
XX = ± .010
XXX = ± .005
ANGLES = ± 0 DEG.30 MIN

20028	SOLAR-A
NEXT ASSY	USED ON
APPLICATION	

CONTR NAS8-37334
DCA/CI

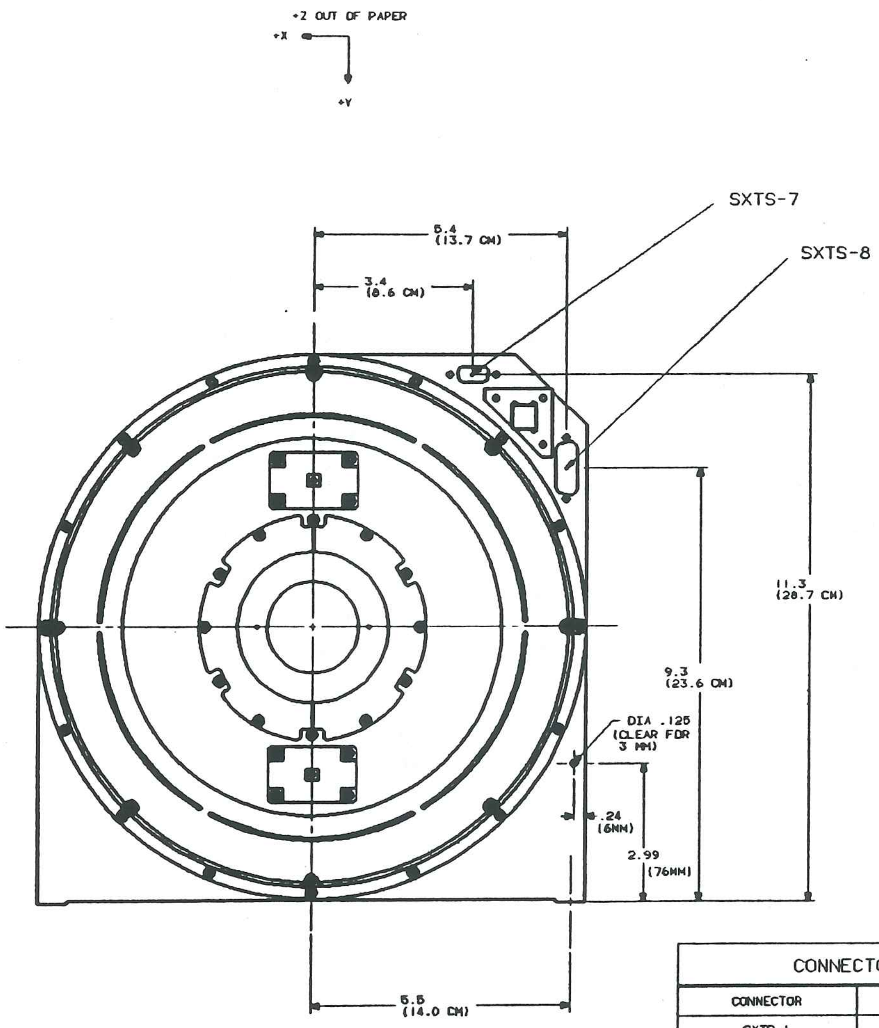
DATE 89-02-20
DWN B.K. JURCEVICH
APVD R. CARAVALHO
APVD M. BRUNER
ENGRG R. CARAVALHO
CHKR Z. PERI
APVD T. FLOWERDAY
APVD M. FINCH

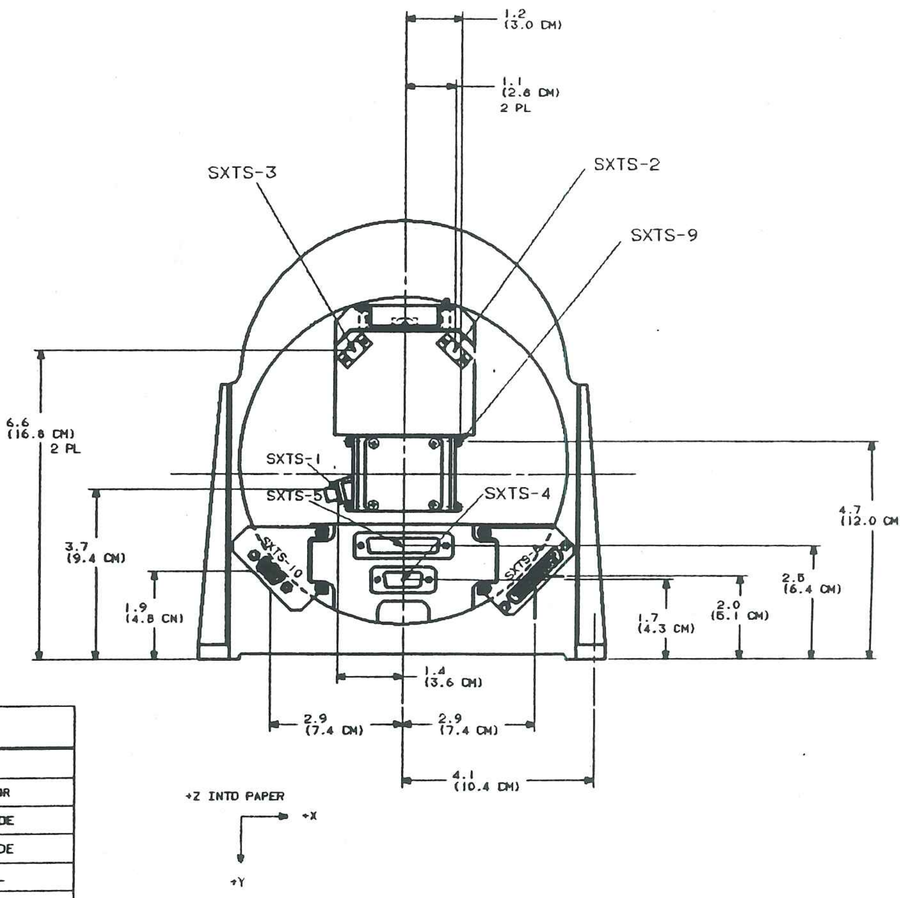
LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

CCD CABLE LAYOUT
SOLAR-A/SXT

SIZE E
FSCM 65113
DRAWING NO SXT-25C66
REV D
SCALE 1/1

ZONE	REV	ION	DATE	APVD
	A	ADDED NOTES AND TABLE.	2/19/90	BKJ





NOTES:

1. DIMENSIONS TO CONNECTORS ARE TO THE CENTER OF THE CONNECTOR.

CONNECTOR TABLE

CONNECTOR	LOCATION
SXTS-1	SHUTTER MOTOR
SXTS-2	CCD H. +X SIDE
SXTS-3	CCD H. -X SIDE
SXTS-4	FILTER WHEEL
SXTS-5	FILTER WHEEL
SXTS-6	HOUSEKEEP, +X SIDE
SXTS-7	FWD SUP PL, -Y SIDE
SXTS-8	FWD SUP PL, -X SIDE
SXTS-9	CCD H. +Y SIDE
SXTS-10	HOUSEKEEP, -X SIDE

P. 2-15
FIGURE 2. 3-4

EICA REF DWG. NOT FOR MFG

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES TOLERANCED ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .1
.XX = ± .03
.XXX = ± .010
ANGLES = ± 2 DEG
CONTR NAS8-37334
CCA/CT

2M003 | SOLAR-A
NEXT ASSY | USED ON

DATE 89-06-24
DWN K. GOWEN
AP.D M. BRUNER
APVD J. VIEIRA
ENGRG B. JURCEVICH
CHKR J. VIEIRA
APVD L. JOHMANN
APVD M. FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORY
PALO ALTO, CALIFORNIA

CONNECTORS,
SXT-S
SOLAR-A

SIZE E | FSCM 65113 | DRAWING NO SXT-2E080 | REV A
SH 1 OF 1

2.4 Mechanical Interface -

2.4.1 SXTS Instrument -

The SXTS instrument shall be mounted within the SOLAR-A spacecraft by means of 6 mm screws within precision bushings as shown in Figure 2.4-1 [SXT-26020]. The 6 mm screws will be furnished by the Japanese side and the bushings by the US side. The footprint of the SXTS instrument and the TSA interface to the spacecraft is shown in Figure 2.4-2 [SXT-2M002] and in Figure 2.2-2 [SXT-2M001]Flight Model Envelope Drawing. The exact relative location of the ten (10) mounting holes and six bushings will be determined by a drilling template/alignment fixture (see paragraph 2.5.2) to be supplied by LPARL to ISAS/NAOJ/IAUT. One bushing sample will also be supplied by LPARL to ISAS/NAOJ/IAUT for fit check.

The TSA Bulkhead capture Block is shown in Figure 3.3-4 [SXT-25C62]. The TSA interface to the spacecraft is shown in Figure 2.4-9. The TSA bulkhead is mounted on the spacecraft bottom panel with seven 4 mm screws, which are to be supplied by the Japanese side.

2.4.2 SXT Electronics Boxes -

There are three electronics boxes all together; CCDE/P, FDE, and SXTE-U. The CCDE/P shall be mounted into the SOLAR-A spacecraft with 4mm screws. SXTE-U box shall be mounted with 6 mm screws. FDE shall be mounted with 5 mm screws. The screws will be torqued with the standard value for that size of screw as given in section 2.4.4.
All screws will be supplied by the Japanese side. All ground straps will be attached with 3 mm screws. The CCDE and CCDP are contained in one box, with the CCDE on top of the CCDP. The mounting footprints of the three (3) SXT electronics boxes are shown in Figures 2.4-3, 2.4-5, and 2.4-6. The boxes are thermally insulated from the spacecraft. The CCD box is thermally and electrically insulated. For Thermal Isolators see Figure 3.3-5A(FDE), -5B(CCDE/P), -5C(SXTE-U).

2.4.3 Fasteners -

All threaded fasteners will be secured with locking threaded inserts or low-outgassing epoxy around the screw heads.

2.4.4 Connector Fastener And Box Mounting Screw Torques -

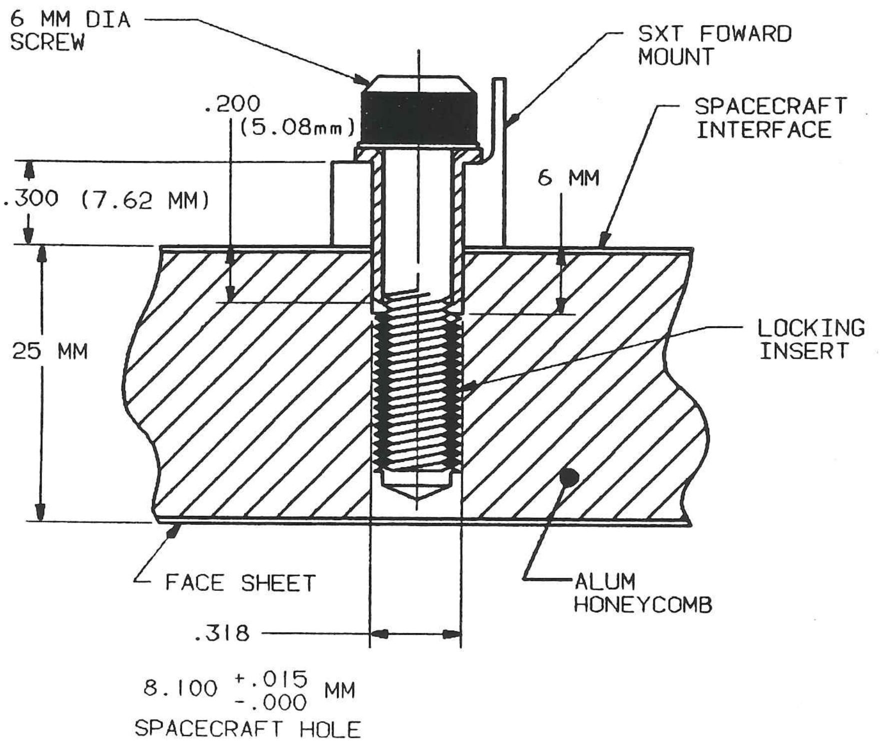
The connectors on the bulkhead shall have fasteners with female entry for the fasteners on the harness. These bulkhead fasteners shall secured with a torqued of 4.5 kgcm +- 0.5 kgcm.

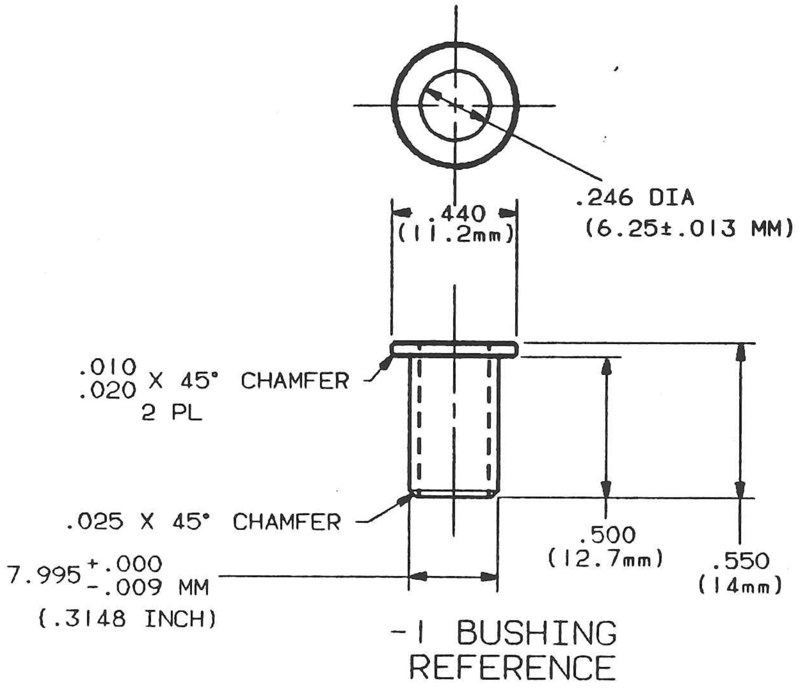
The connectors on the harness shall have fasteners that screw into the mating part on the bulkhead with a torque of 3.5 kgcm +- 0.5 kgcm.

The boxes shall be mounted using the following torque on the screws.

Box	Screw size	Torque (specified by Solar-A-102)
SXTS	M6	75 kg-cm
SXTE-U	M6	75 kg-cm
FDE	M5	42 kg-cm
CCDE/P	M4	21 kg-cm

REVISIONS				
ZONE	REV	DESCRIPTION	D	APVD
	A	ADDED NOTES.	2/1	BKJ





EICA REF DWG, NOT FOR MFG

NOTES:

1. SHIMS AVAILABLE IN .5mm, 1mm, 1.5mm, AND 2mm THICKNESS.
2. FOR BUSHING DETAILS SEE SXT-2C004.

P. 2-18
FIGURE 2. 4-1

2C011	SOLAR-A
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG.30MIN
CONTR NAS8-37334
CCA/CI

DATE 28 JANUARY 88
DWN Edward Thelen
APVD B.K.JURCEVICH
APVD M.E.BRUNER
ENGRG Edward Thelen
CHKR J.R.VIEIRA
APVD G.GRADWOHL
APVD M.FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

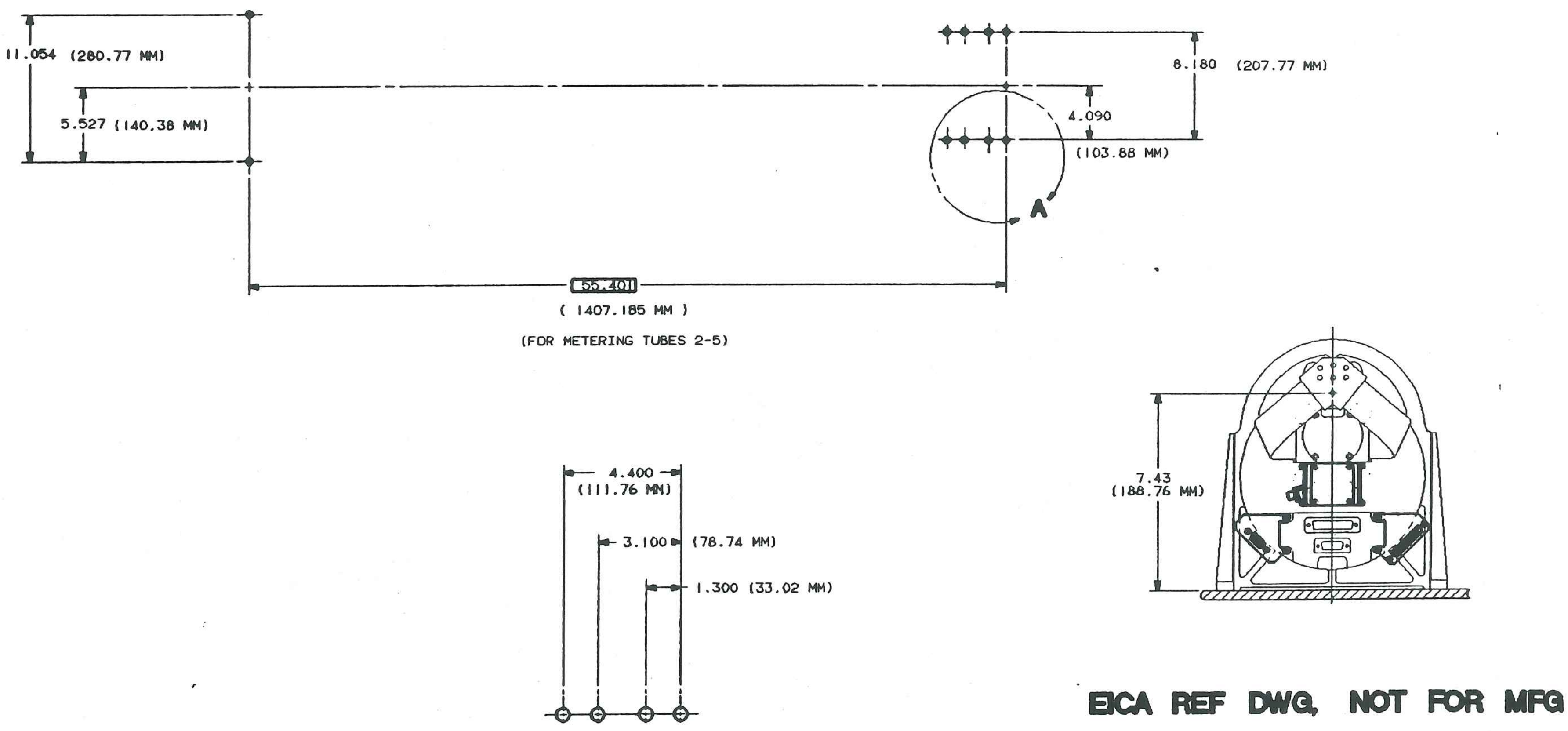
MOUNTING INTERFACE,
SOLAR-A/SXT

SIZE	FSCM	DRAWING NO D9120 SKETCH	REV
C	65113	SXT-26020	A
SCALE 3/1		SH 1 OF 1	

SXT-26020 A

91-20

ZONE	REV	DESCRIPTION	DATE	APVD
	A	ADDED NOTES.	2/19/90	BKJ



VIEW **A**
(NOT TO SCALE)

NOTES:

1. SXTS MOUNTING HOLES TRANSFERED TO SPACECRAFT USING DRILL TEMPLATE SXT-20010. ALSO SEE SXT-20011.

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG,30 MIN
CONTR NAS8-37334

SOLAR-A

DATE 88-06-20
DWN B.K. JURCEVICH
APVD J.R.VIEIRA
APVD M.BRUNER
ENGRG B.K.JURCEVICH
CHKR J.R.VIEIRA
APVD G.GRADWOHL

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

SXT INSTRUMENT FOOTPRINT

SIZE D FSCM 65113 DRAWING NO SXT-2M002 REV A

FIGURE 2. 4-2

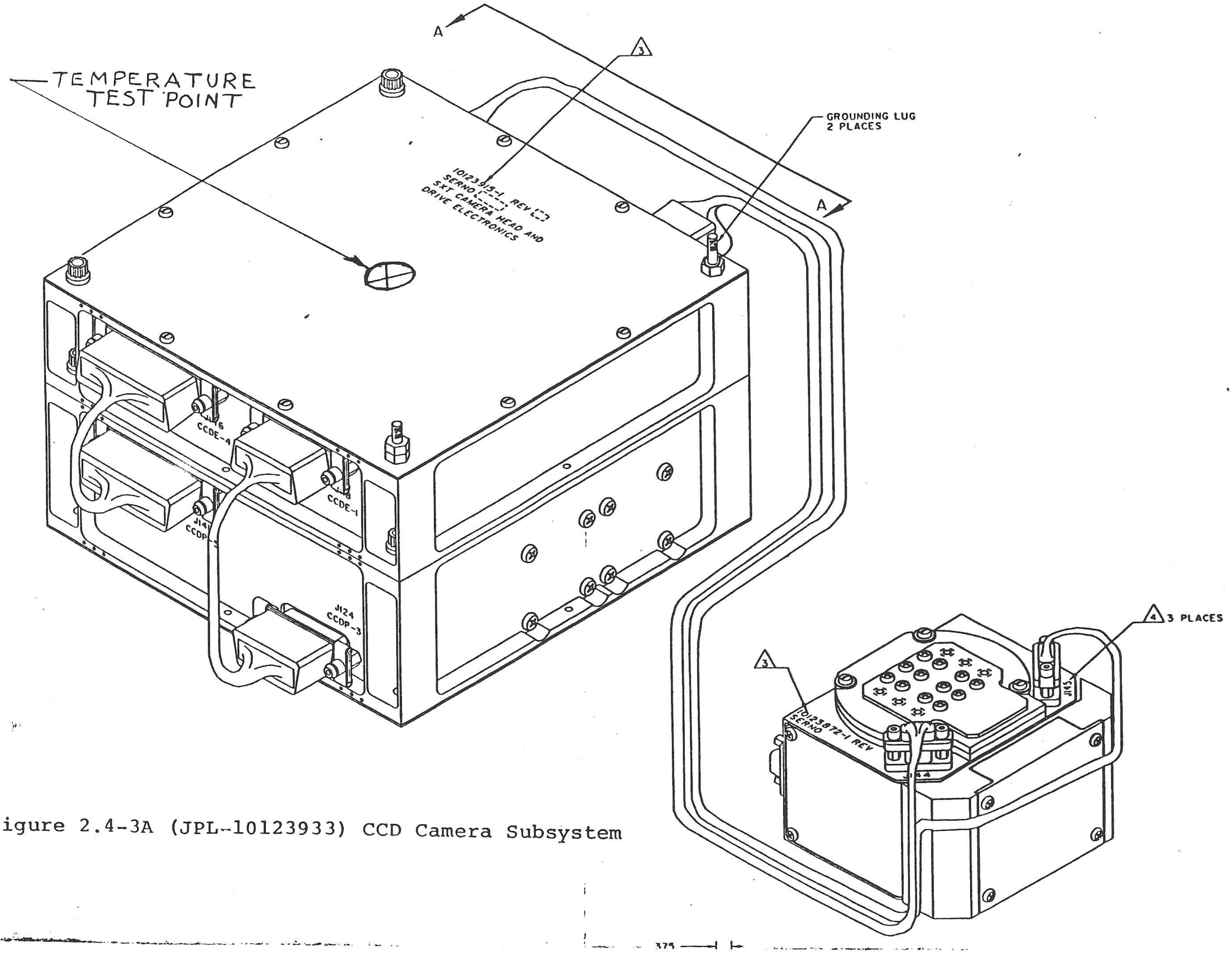


Figure 2.4-3A (JPL-10123933) CCD Camera Subsystem

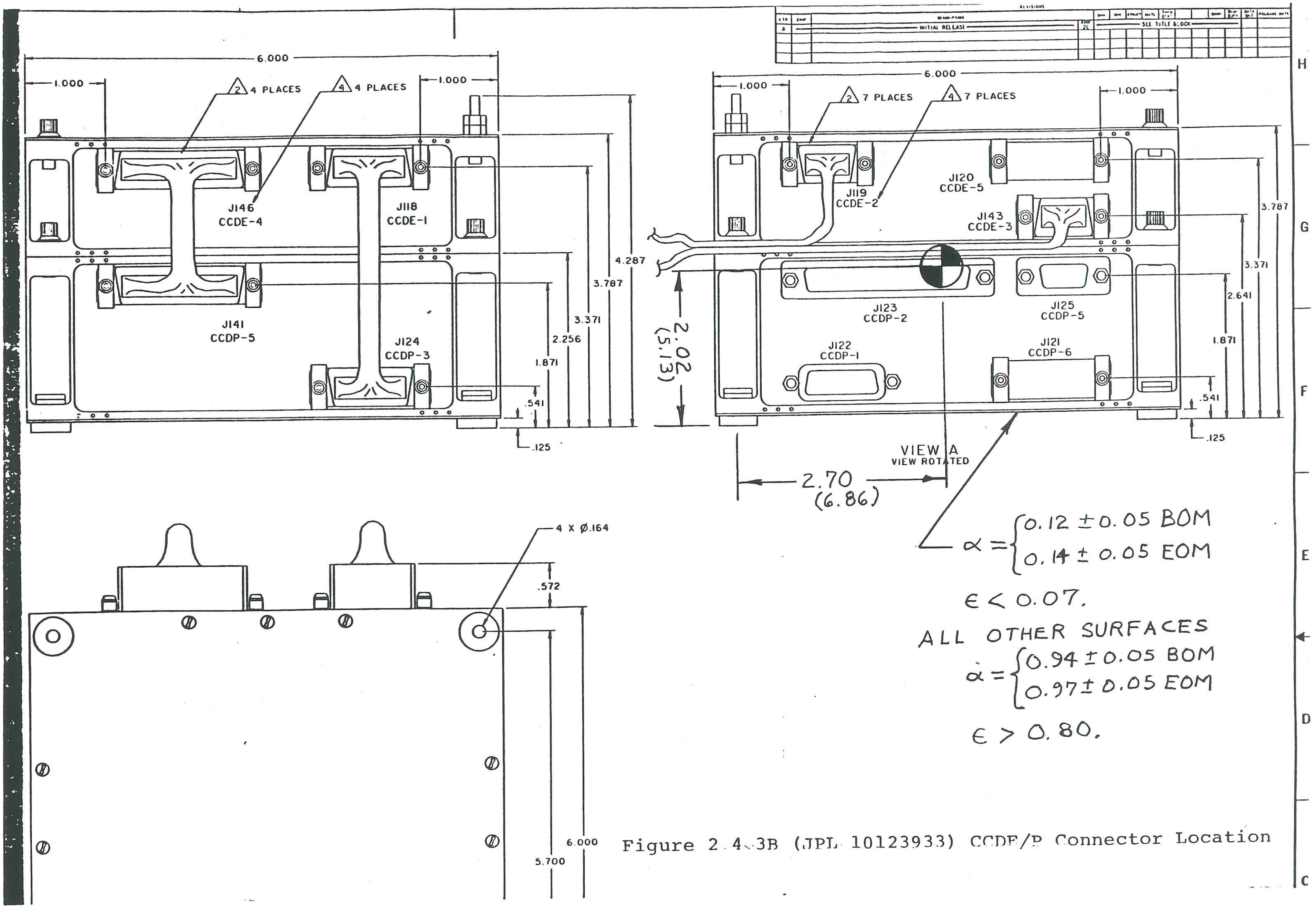


Figure 2.4.3B (JPL 10123933) CCDF/P Connector Location

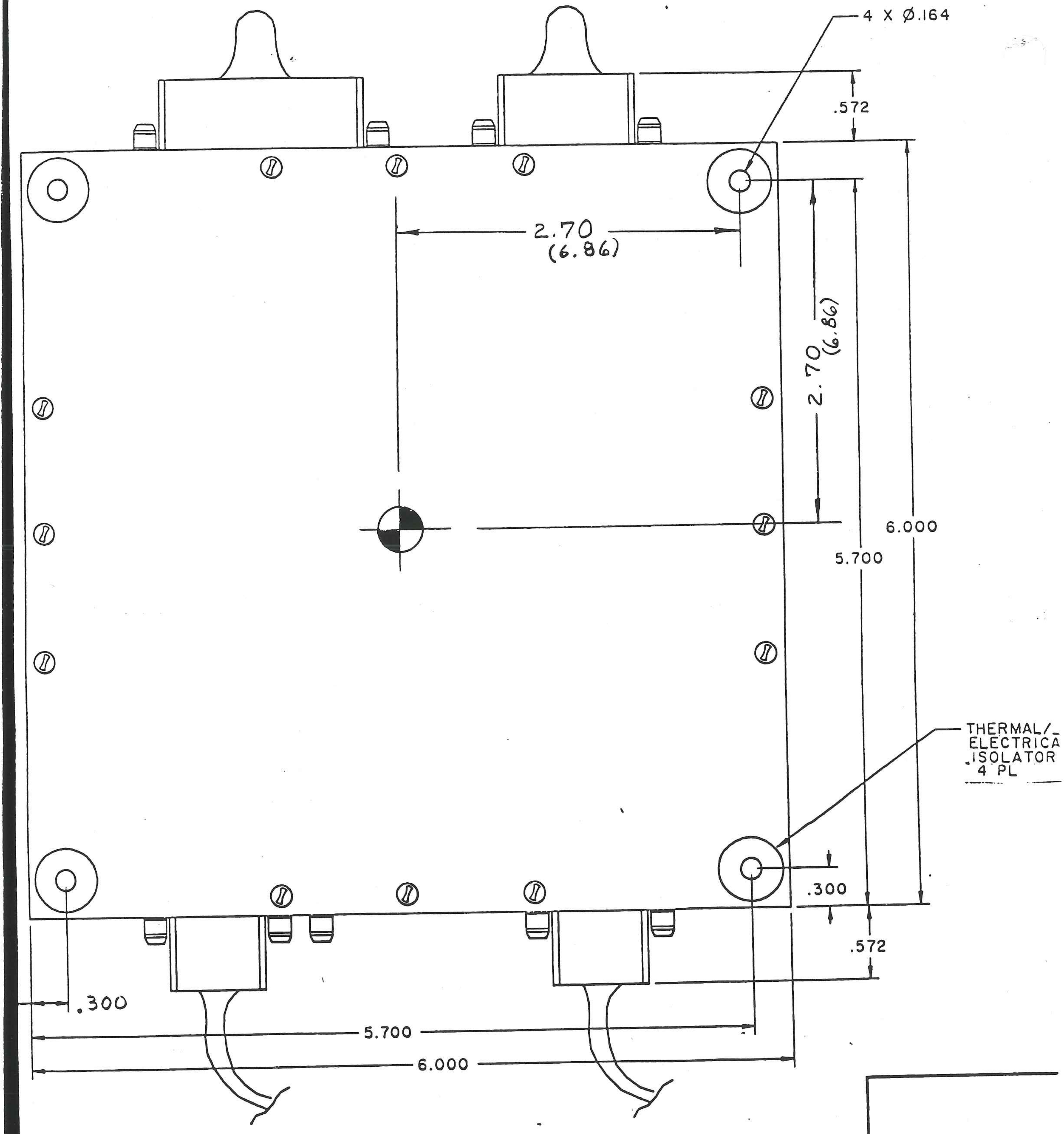


Figure 2.4-3C (JPL-10123933) CCDE/P Mounting Footprint

FRAME	CAGE NO	DRAWING NUMBER	REV	SH NO
1 of 2	23835	10123933	A	1

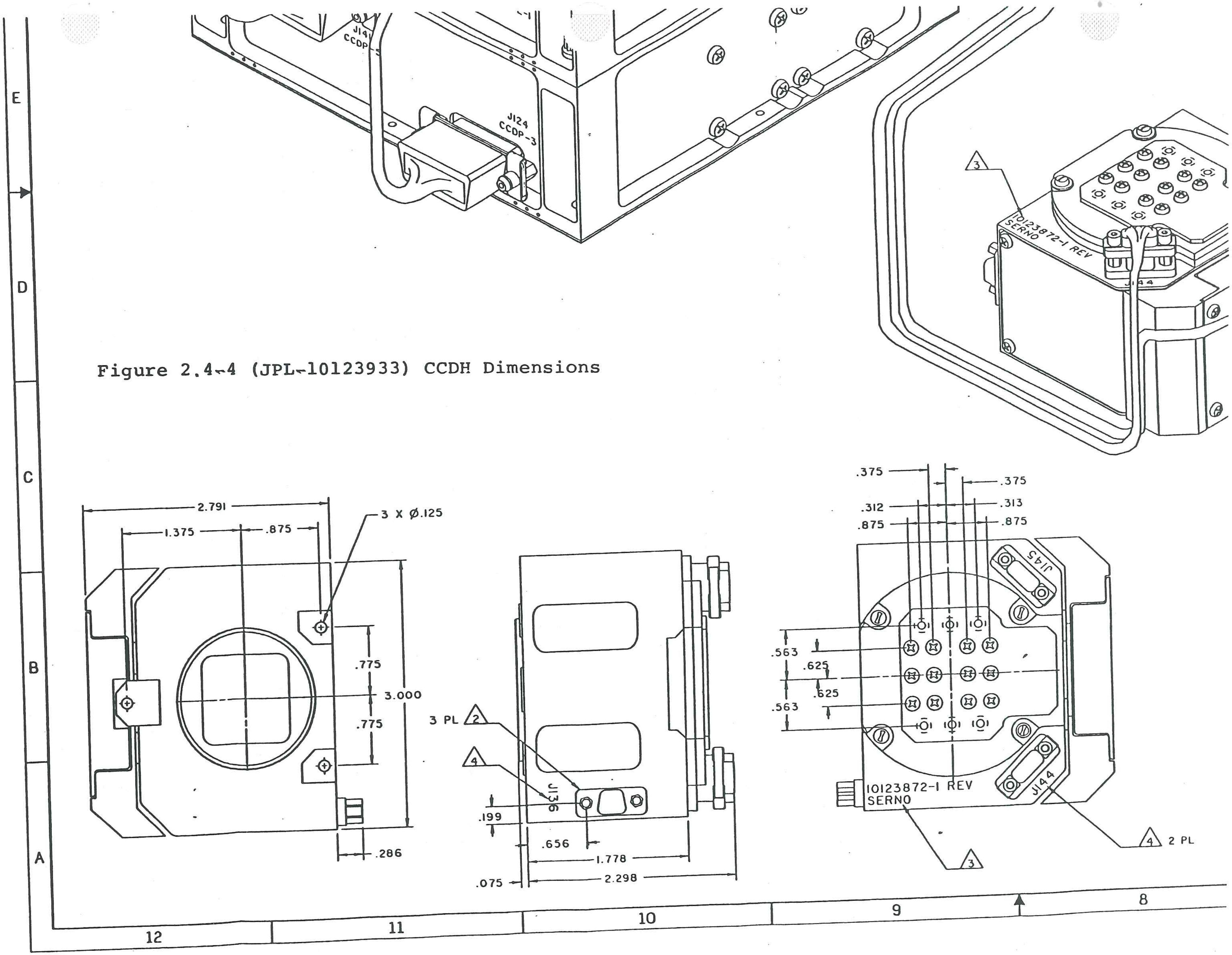
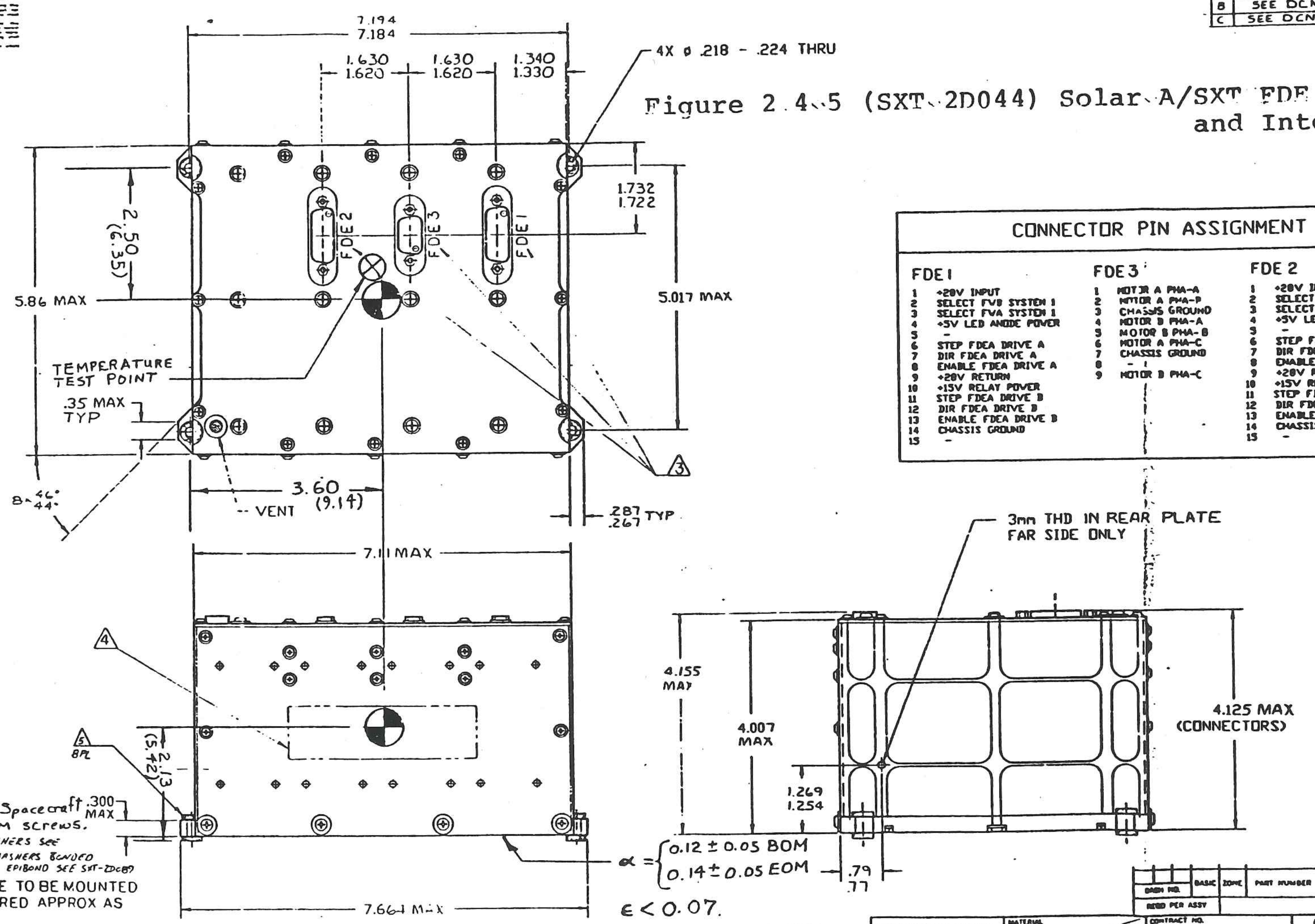


Figure 2.4-4 (JPL-10123933) CCDH Dimensions

Figure 2.4.5 (SXT-2D044) Solar-A/SXT FDE Outline and Interface



$\alpha = \begin{cases} 0.12 \pm 0.05 \text{ BOM} \\ 0.14 \pm 0.05 \text{ EOM} \end{cases}$

$\epsilon < 0.07$.

ALL OTHER SURFACES

$\alpha = \begin{cases} 0.94 \pm 0.05 \text{ BOM} \\ 0.97 \pm 0.05 \text{ EOM} \end{cases}$

$\epsilon > 0.8$.

CONNECTOR PIN ASSIGNMENT

FDE1		FDE3		FDE2	
1	+20V INPUT	1	MOTOR A PHA-A	1	+20V INPUT
2	SELECT FVB SYSTEM 1	2	MOTOR A PHA-B	2	SELECT FVB SYSTEM 2
3	SELECT FVA SYSTEM 1	3	CHASSIS GROUND	3	SELECT FVA SYSTEM 2
4	+5V LED ANODE POWER	4	MOTOR B PHA-A	4	+5V LED ANODE POWER
5	-	5	MOTOR B PHA-B	5	-
6	STEP FDEA DRIVE A	6	MOTOR A PHA-C	6	STEP FDEB DRIVE A
7	DIR FDEA DRIVE A	7	CHASSIS GROUND	7	DIR FDEB DRIVE A
8	ENABLE FDEA DRIVE A	8	-	8	ENABLE FDEB DRIVE A
9	+28V RETURN	9	MOTOR B PHA-C	9	+28V RETURN
10	+15V RELAY POWER			10	+15V RELAY POWER
11	STEP FDEA DRIVE B			11	STEP FDEB DRIVE B
12	DIR FDEA DRIVE B			12	DIR FDEB DRIVE B
13	ENABLE FDEA DRIVE B			13	ENABLE FDEB DRIVE B
14	CHASSIS GROUND			14	CHASSIS GROUND
15	-			15	-

5 Attach to Spacecraft Using 5mm screws. ISOLATION WASHERS SEE SXT-2DC25. WASHERS BONDED TO FDE USING EPIBOND SEE SXT-2DC89

4 IDENT PLATE TO BE MOUNTED AND CENTERED APPROX AS SHOWN.

3 IDENTIFICATION TO BE MARKED WITH WHITE WORNO INK 14-9-N [illegible]

2. ESTIMATED PACKAGE WEIGHT: 3.9 LBS.

1. CONNECTORS ARE 'D' SUBMINIATURE; FDE1 AND FDE2 ARE 15-PIN MALE, FDE3 IS 9-PIN FEMALE.

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	R/C	RELEASE TO PRODUCTION	[illegible]	
	A	SEE DCN	[illegible]	
	B	SEE DCN	1-?-89	
	C	SEE DCN	8-13-89	

PRODUCTION RELEASE
PROTOTYPE RELEASE
RECORD RELEASE
EXPERIMENTAL RELEASE
PROTOTYPE RELEASE
DATE JUL 1? '8?

DASH NO.	BASIC	ZONE	PART NUMBER	CODE IDENT	DESCRIPTION	REFERENCE DESIGNATOR	ITEM NO.

REQD PER ASSY

PARTS LIST

UNLESS OTHERWISE SPECIFIED
INTPR DWG PER MIL-STD-100
DIM ARE IN INCHES
DO NOT SCALE DRAWING
DIM TO BE MET AFTER FINISH
DIA ⊙ TIR
SURFACE ROUGHNESS √

CUSTOMER & SPEC

SIMILAR TO

MATERIAL

HEAT TREAT

FINISH

NEXT ASSY 105585

USED ON 105585

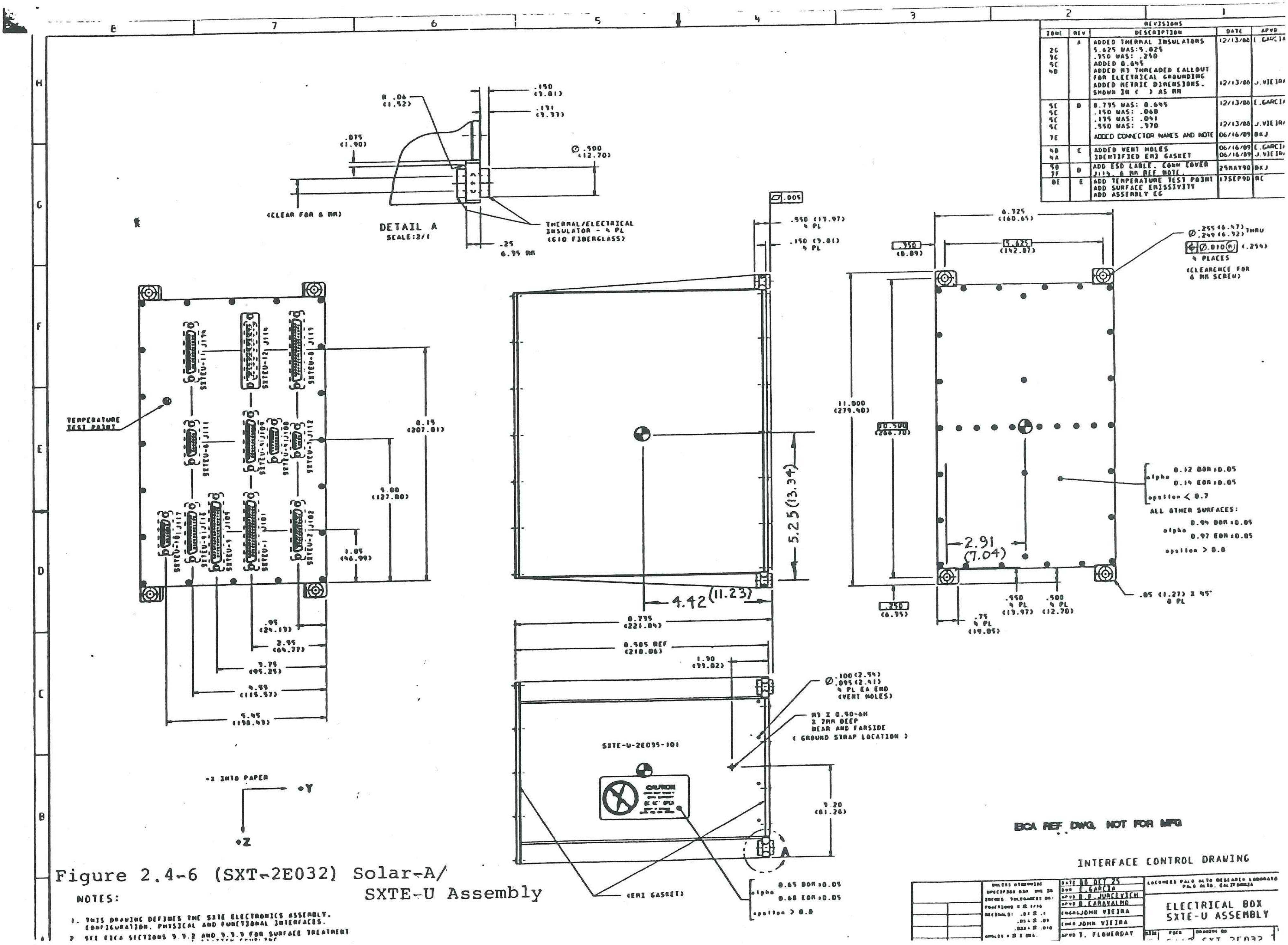
CONTRACT NO.
DRAWN BY
CHECKED
DESIGNER
MECH APPR
ELEC APPR 1/49
APPROVED Q.A. 1/?/89

SCHAEFFER MAGNETICS, INC.
CHATSWORTH, CA 913

TITLE OUTLINE & INTERFACE FILTER WHEEL ELECTRONICS

SIZE D
CODE IDENT NO 29371
DWG NO. 105585
SXT-2D044

SCALE 1/1
WT
SHEET 1 OF



REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
2G 3G 4C 4D	A	ADDED THERMAL INSULATORS 5.625 WAS: 5.825 .350 WAS: .250 ADDED 8.645 ADDED M3 THREADED CALLOUT FOR ELECTRICAL GROUNDING ADDED METRIC DIMENSIONS. SHOWN IN ( ) AS MM	12/13/88 12/13/88	E. GARCIA J. VIEIRA
5C 5C 5C 5C 7E	B	8.795 WAS: 8.645 .150 WAS: .060 .175 WAS: .041 .550 WAS: .370 ADDED CONNECTOR NAMES AND NOTE	12/13/88 12/13/88 06/16/89	E. GARCIA J. VIEIRA BKJ
4B 4A	C	ADDED VENT HOLES IDENTIFIED EMI GASKET	06/16/89 06/16/89	E. GARCIA J. VIEIRA
5D 7F	D	ADD ESD LABLE. CONN COVER J115. 6 MM REF NOTE.	25MAY90	BKJ
8E	E	ADD TEMPERATURE TEST POINT ADD SURFACE EMISSIVITY ADD ASSEMBLY CG	17SEP90	RC

Figure 2.4-6 (SXT-2E032) Solar-A/ SXTE-U Assembly

NOTES:

1. THIS DRAWING DEFINES THE SXTE ELECTRONICS ASSEMBLY. CONFIGURATION, PHYSICAL AND FUNCTIONAL INTERFACES.
2. SEE EICA SECTIONS 3.3.2 AND 3.3.3 FOR SURFACE TREATMENT

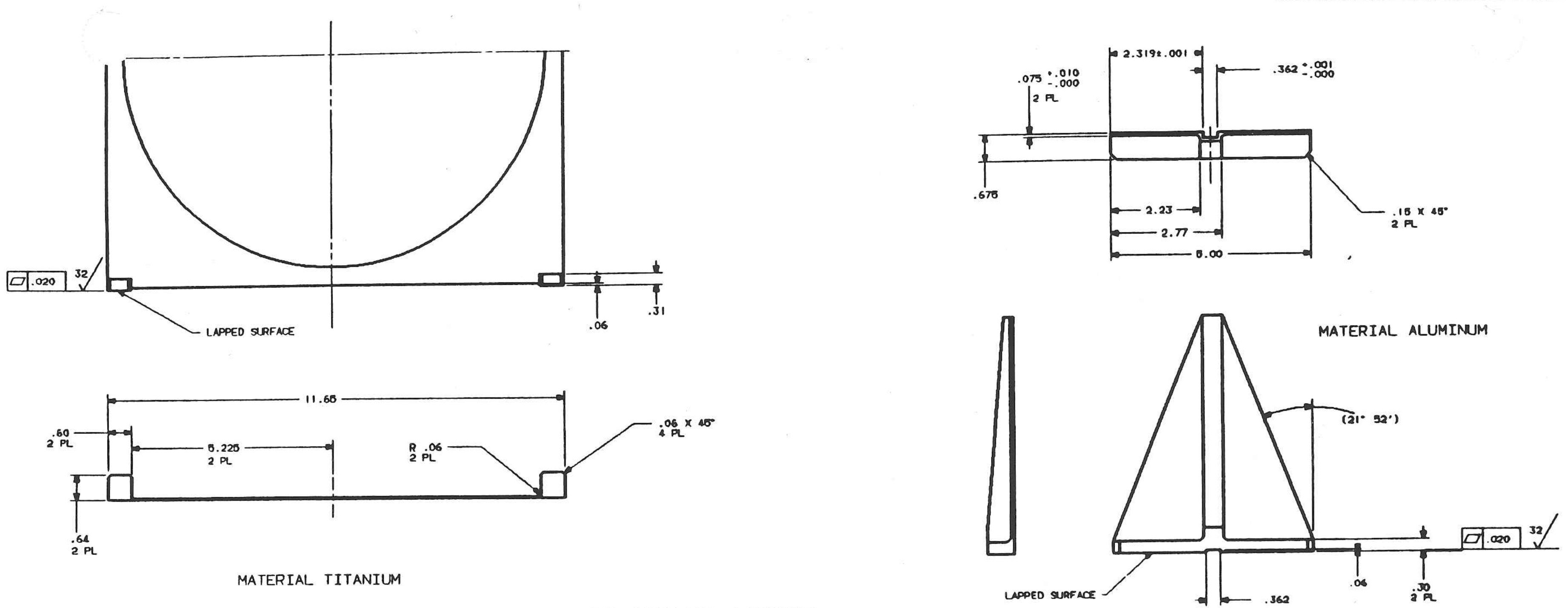
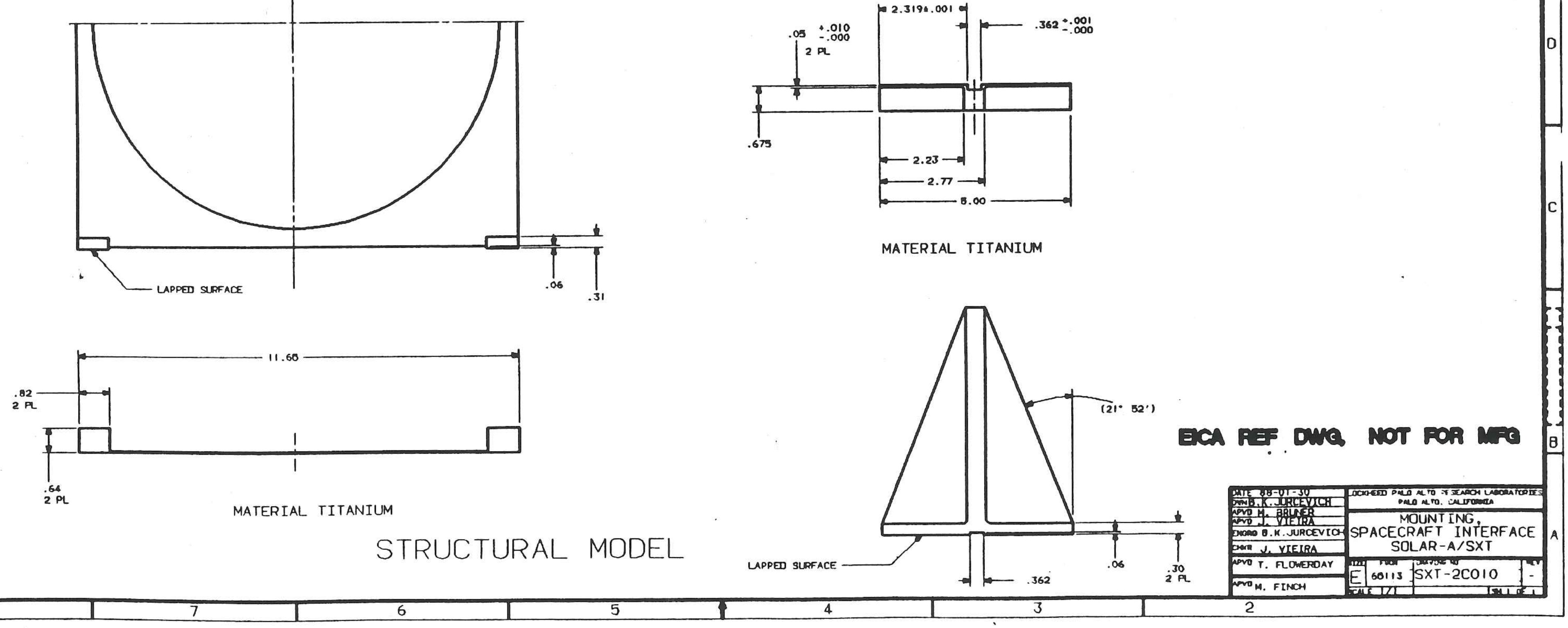
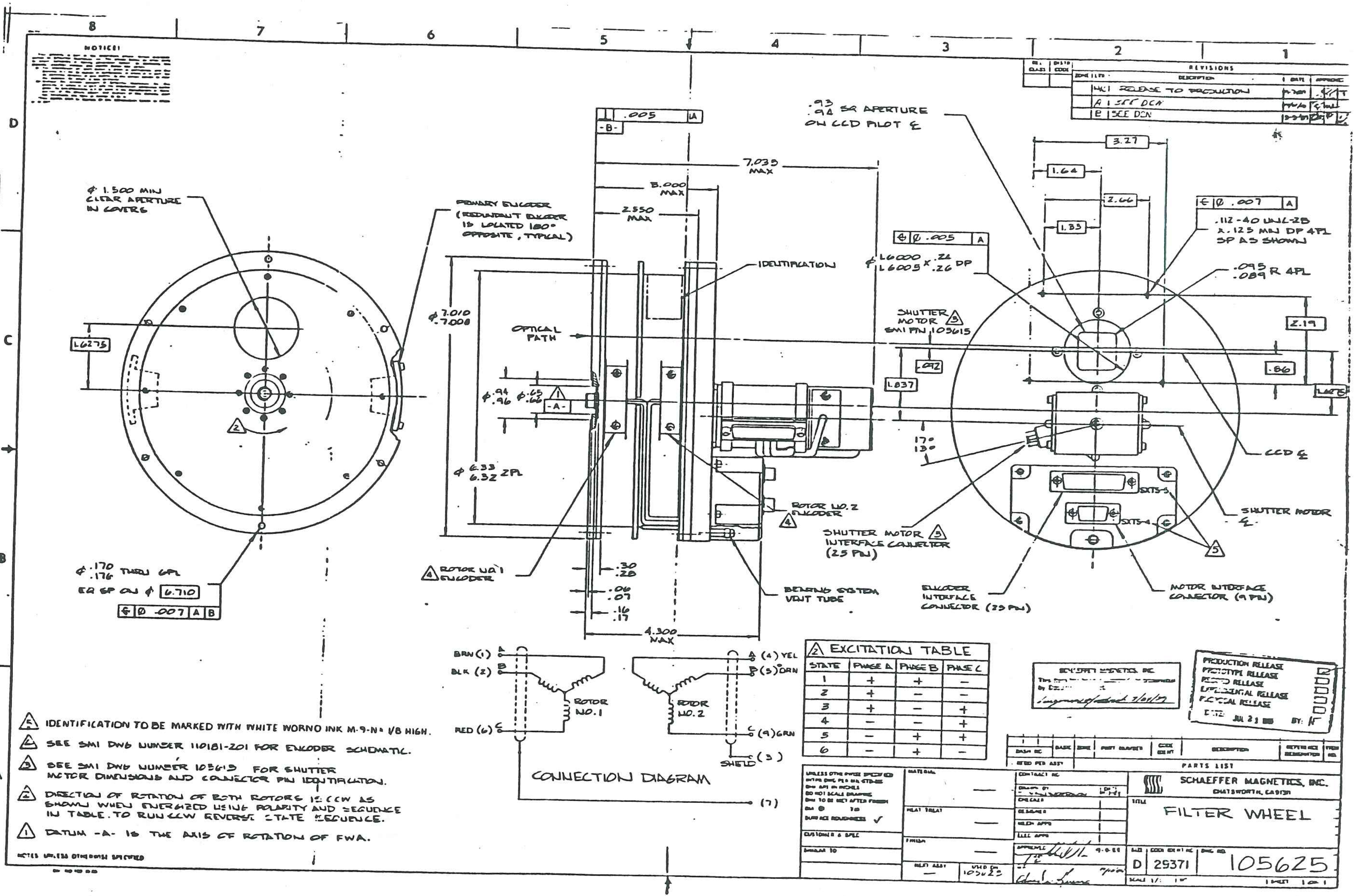


Figure 2.4-7 (SXT-2C010) Solar-A/SXT FLIGHT MODEL Spacecraft Interface Mounting





⑤ IDENTIFICATION TO BE MARKED WITH WHITE WORNO INK M-9-N 1/8 HIGH.

④ SEE SMI DWG NUMBER 110181-201 FOR ENCODER SCHEMATIC.

③ SEE SMI DWG NUMBER 105615 FOR SHUTTER MOTOR DIMENSIONS AND CONNECTOR PIN IDENTIFICATION.

② DIRECTION OF ROTATION OF BOTH ROTORS IS CCW AS SHOWN WHEN ENERGIZED USING POLARITY AND SEQUENCE IN TABLE. TO RUN CCW REVERSE STATE SEQUENCE.

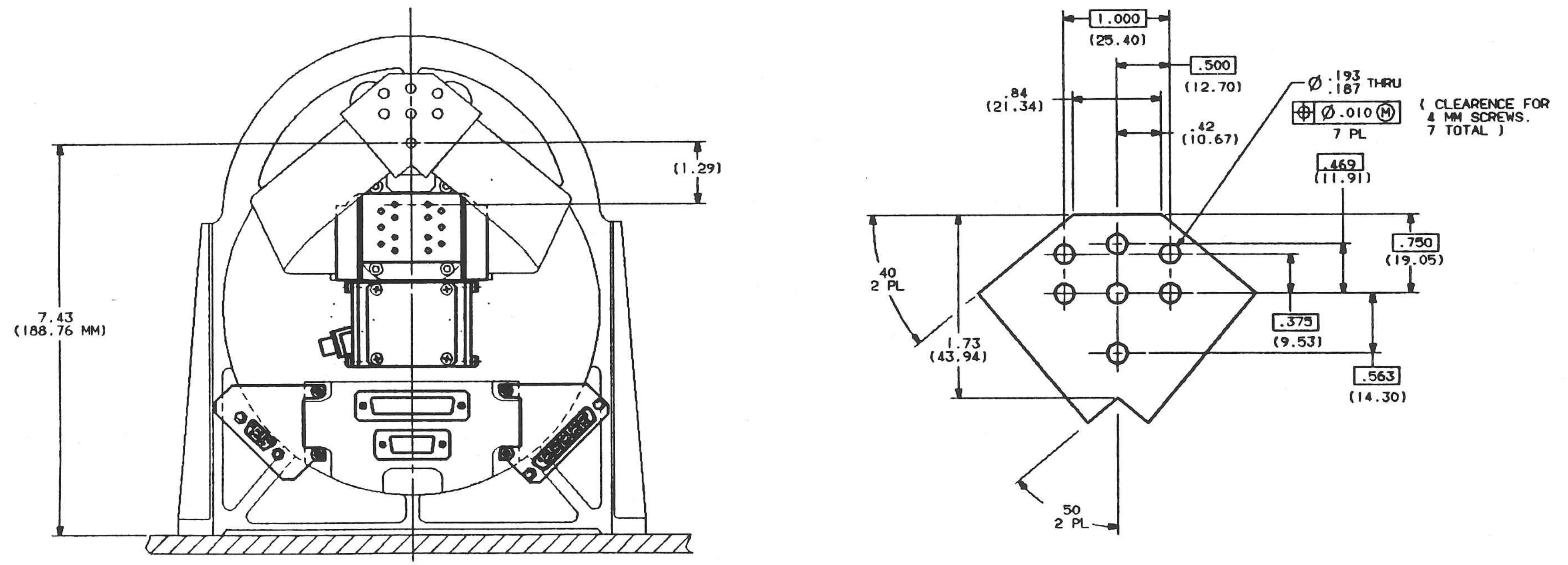
① DATUM -A- IS THE AXIS OF ROTATION OF FWA.

② EXCITATION TABLE

STATE	PHASE A	PHASE B	PHASE C
1	+	+	−
2	+	−	−
3	+	−	+
4	−	−	+
5	−	+	+
6	−	+	−

Figure 2.4-8 [SXT-2D045] Filter Wheel

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
	A	REVERSED SXTS-4 & SXTS-5	12JUL89	KFG
	B	UPDATE, EICA NOTE,REF DIM	24APR90	BKJ



EICA REF DWG, NOT FOR MFG

FIGURE 2. 4-9

		UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON, FRACTIONS = ± 1/16 DECIMALS, .X = ± .03 .XX = ± .010 .XXX = ± .005 ANGLES = ± 0 DEG,30 MIN	DATE 88-01-30 DWN B.K.JURCEVICH APVD J.R.VIEIRA APVD M. BRUNER ENGRG B.K.JURCEVICH CHKR J.R.VIEIRA	LOCKHEED PALO ALTO RESEARCH LABORATORIES PALO ALTO, CALIFORNIA THERMAL STRAP, SPACECRAFT INTERFACE SOLAR-A/SXT
2D028	SOLAR-A	CONTR NAS8-37334	APVD T. FLOWERDAY	SIZE D FSCM 65113 DRAWING NO SXT-2D026 REV B
NEXT ASSY	USED ON	CCA/CI	APVD M. FINCH	SCALE NONE SH 1 OF 1
APPLICATION				

2.5 SXT Alignment -

The optical axis of the SXT instrument is to be aligned with the BCS and HXT Co-observing instruments such as to meet the scientific requirement of co-observing. The requirement are contained in Table J.2-1.

2.5.1 SXT Alignment Reference Cube -

The SXTS alignment cube located on the forward end of the telescope (see Figure 2.5-1) will be used to measure the misalignment angle between the the spacecraft axis and the optical axis. The misalignment angle of the SXTS optical axis with SXTS alignment cube will be measured by an auto-collimator. This will give the coordinates (Ax,Ay). The misalignment angle of the SXTS cube with respect to an alignment cube on the SXTS drilling template will be measured giving the coordinates (Bx,By). The total misalignment angle of the SXTS optical axis with respect to the cube on the template will then be known as (Cx,Cy) = (Ax+Bx,By+Ay). This in turn will be used to determine the misalignment between the spacecraft and the SXTS optical axis. (The alignment cube will be removed before flight.)

2.5.2 Drilling Template/Alignment Fixture -

In order to assure that the SXT mounting bushings will fit the hole pattern in the spacecraft and the mounted instrument will be properly aligned, LPARL will supply a drilling template to ISAS/NAOJ/IAUT. This template will be equipped with an optical reference cube which has a known angular relationship to the SXT line of sight. Figures 2.5-2 and 2.5-3 show this drilling template/alignment fixture. Figure 2.4-1 shows the bushings used to establish a mounting reference of SXTS to the Template.

2.5.3 CCD Coordinates -

Note: SXT optics will invert images

```
                 Titanium Housing
                /-------------------\
            /          CCD            \          S/C Axis +Z (towards
         /         _____N____1           \                     you)
        |          |          |            |      +X <---------O
        |         W|          |E           |                   |
        |          |          |            |                   |
        |          |          |            |                   |
output----+------>+_|__________|            |                   |
        |          Serial Reg.             |                   V +Y
        |_______________S__________________|            Ecliptic North
               INSTRUMENT BASEPLATE
```

View down optical axis from entrance.

CCD Sensor has 1024 pixels with 18.3 micron pixels. The solar image is to be offset 1/8 of array or 2.34 mm. Since the telescope inverts the image, ecliptic north will be in the downward direction (above). The direction of the mechanical offset of the CCD camera and shutter assembly will therefore be toward the instrument mounting plate. The output shift register of the CCD Camera is on the baseplate side of the camera. Point "1" at upper RH corner of CCD indicates location of pin 1 on CCD. The CCD image is organized as follows: Line "1", Sample "1" is in the lower left corner opposite pin 1. In the image, "Lines" or rows of picture elements (pixels) are parallel to the serial register, in the East West direction. The North South direction is perpendicular to the "line" direction along rows of "Samples". Image coordinates are usually specified, as (line,sample) with respect to (1,1).

(0,0)

2.6 Design Requirements -

2.6.1 Design Factors Of Safety -

Design factors of safety are:

If verified by calculation
Yield: 1.25 of Subsystem Level loads
Ultimate: 2.0 of Subsystem Level loads

If verified by test
Yield: 1.1 of Subsystem Level loads
Ultimate: 1.25 of Subsystem Level loads

The design of the SXT will exclude any pressure vessels.

SXT handling fixtures will be tested to two times maximum operational loads. Operational Loads have been determined using the mass data of latest date from Table 2.3-1.

2.6.2 Minimum Natural Frequency -

Experiment hardware shall have a minimum natural frequency greater than 100 Hz when mounted to an infinitely stiff wall.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
	A	UPDATE	23APR90	BKJ

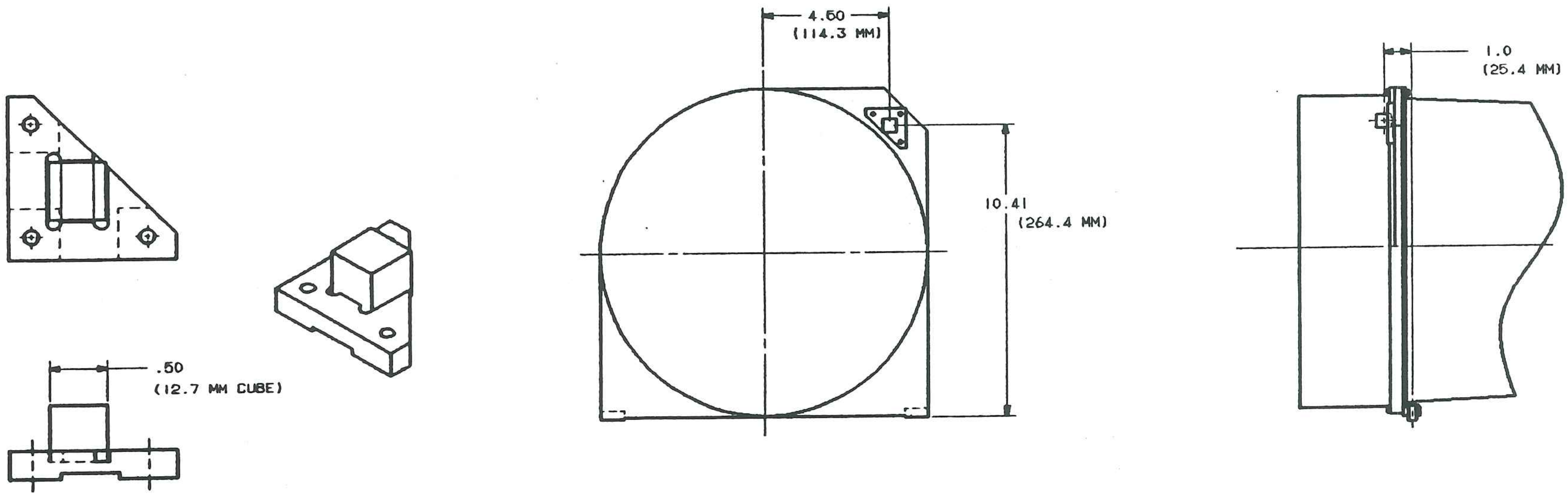
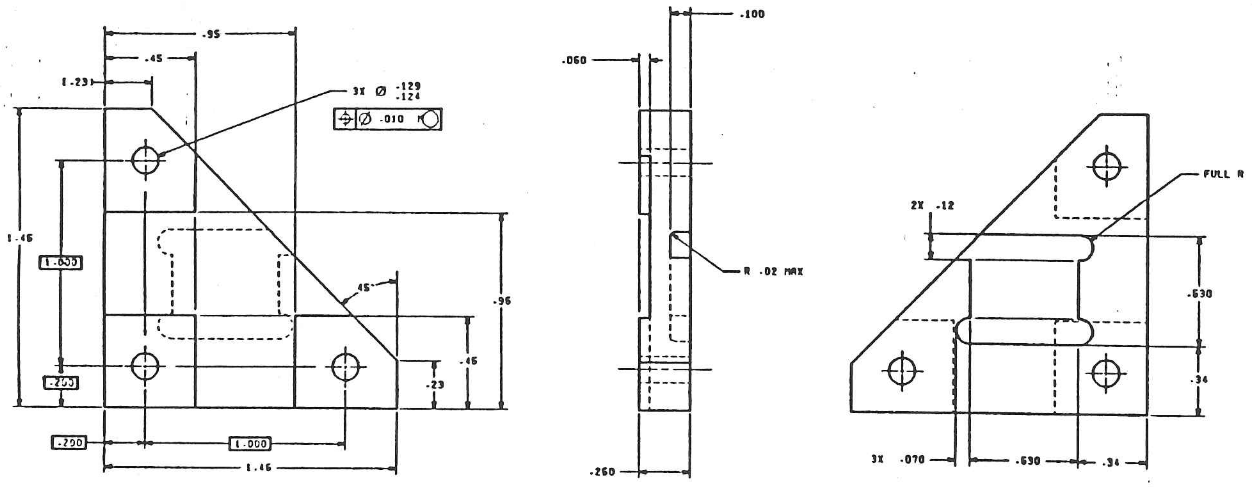


FIGURE 2. 5-1

EICA REF DWG. NOT FOR MFG

DATE 88-06-21	LOCKHEED PALO ALTO RESEARCH LABORATORIES PALO ALTO, CALIFORNIA
DWN B.K. JURCEVICH	ALIGNMENT CUBE MOUNT (EICA FIG. 2.5-1) SOLAR-A/SXT
APVD J.VIEIRA	
APVD M.BRUNER	
ENGRG B.K.JURCEVICH	
CHKR J.VIEIRA	
APVD G.GRADWOHL	SIZE D FSCM 65113 DRAWING NO SXT-21058 REV A



NOTES: (UNLESS OTHERWISE NOTED)

1. MACHINE PER LAC 3601.
2. MARK PART NO. PER LAC 3575-011990.
3. PROTECT AND HANDLE PER LAC 1001.
4. SURFACE ROUGHNESS 63√.
5. FILLET RADII .016 MAX.
6. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982.

Figure 2.5-1A [SXT-21036] Alignment Cube Mount

-		-101	MOUNT	[illegible]	AMS 4911		-
QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL [illegible]	MATERIAL SPECIFICATION	ZONE	[illegible]

22004 SXT

D.J. AKIN

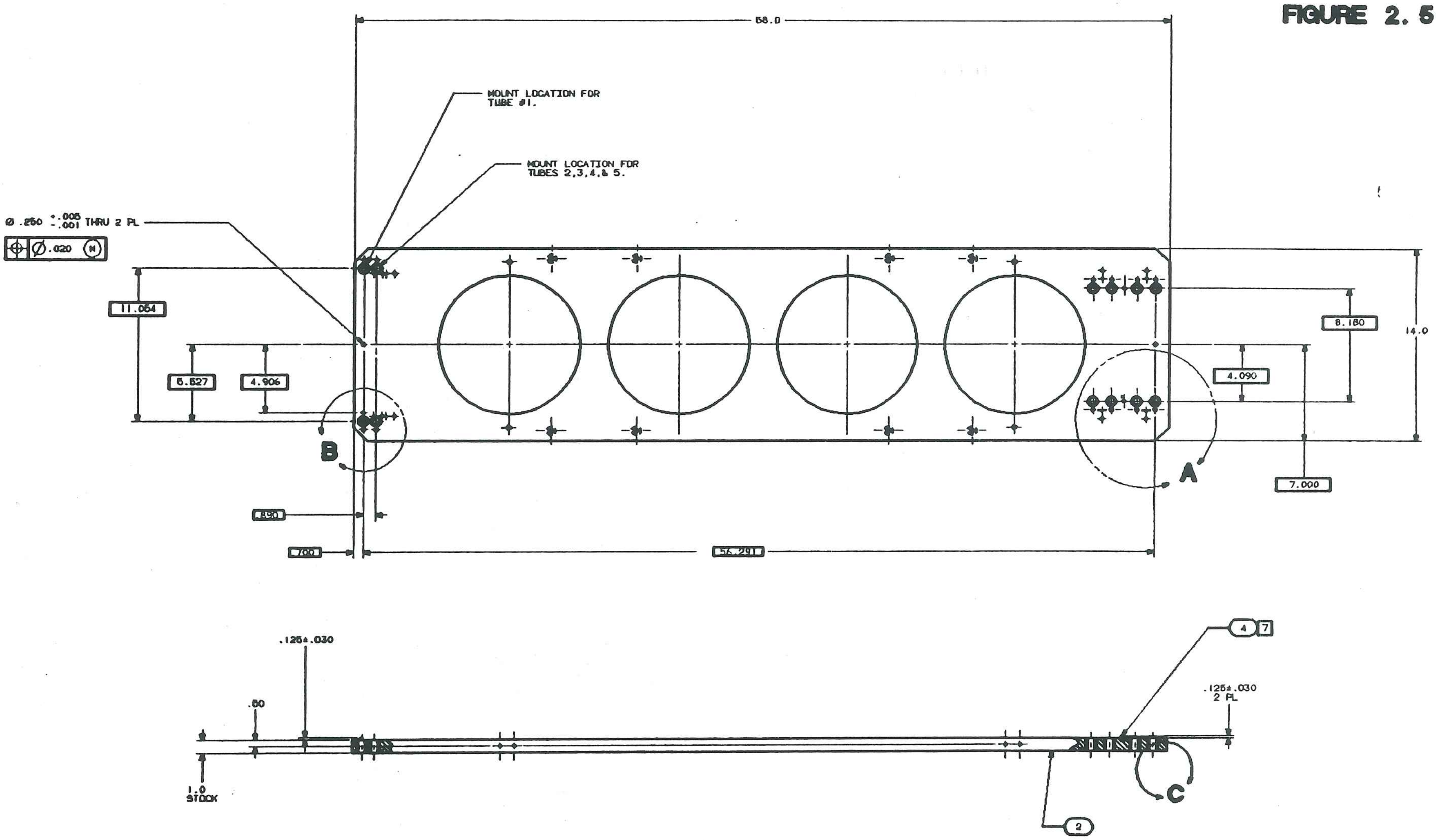
LOCKHEED PALO ALTO RESEARCH LABORATORY

MOUNT, ALIGNMENT CUBE

55113 SXT 21039 1 -

ZONE	REV	DESCRIPTION	DATE	APVD
F6	A	ADD HOLES FOR TUBE 2.3 ETC	19FEB90	BKJ

FIGURE 2.5-2A



-101 PLATE

NOTES: UNLESS SPECIFIED:

1. SURFACE FINISH 64 TO 32 RHR.
2. BREAK EDGES .02 R MAX.
3. FILLETS .03 R MAX.
4. MACHINE TO LAC 3601.
5. 1" X 14" X 60" CAST ALUMINUM TOOLING PLATE. MIC 6 (LUSK METALS) OR EQUIV.
6. CARR LANE, LOS ANGELES.
7. ALIGN TO AFT MOUNT SXT-2C007, SEE SXT-2C011. SEE SXT-20010 FOR INSTRUMENT CONFIGURATION.

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO
3		•	PIN 3/16 DIA X 3/8 LONG				4
10		L-48-16	HEADLESS LINER	6		SH 2	3
1			PLATE	5			2
-		-101	PLATE-DRILL ASSEMBLY				1
-101	PARTS LIST						

UNLESS OTHERWISE SPECIFIED DIM ARE IN INCHES TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG.30 MIN
CONTR NAS8-37334

SOLAR-A

DATE 2 FEBRUARY 88
DWN Edward Thelen
APVD B.K.JURCEVICH
APVD J.R.VIEIRA
ENGR B.K.JURCEVICH
CHKR J.R.VIEIRA
APVD G.GRADWOHL
APVD M FINCH

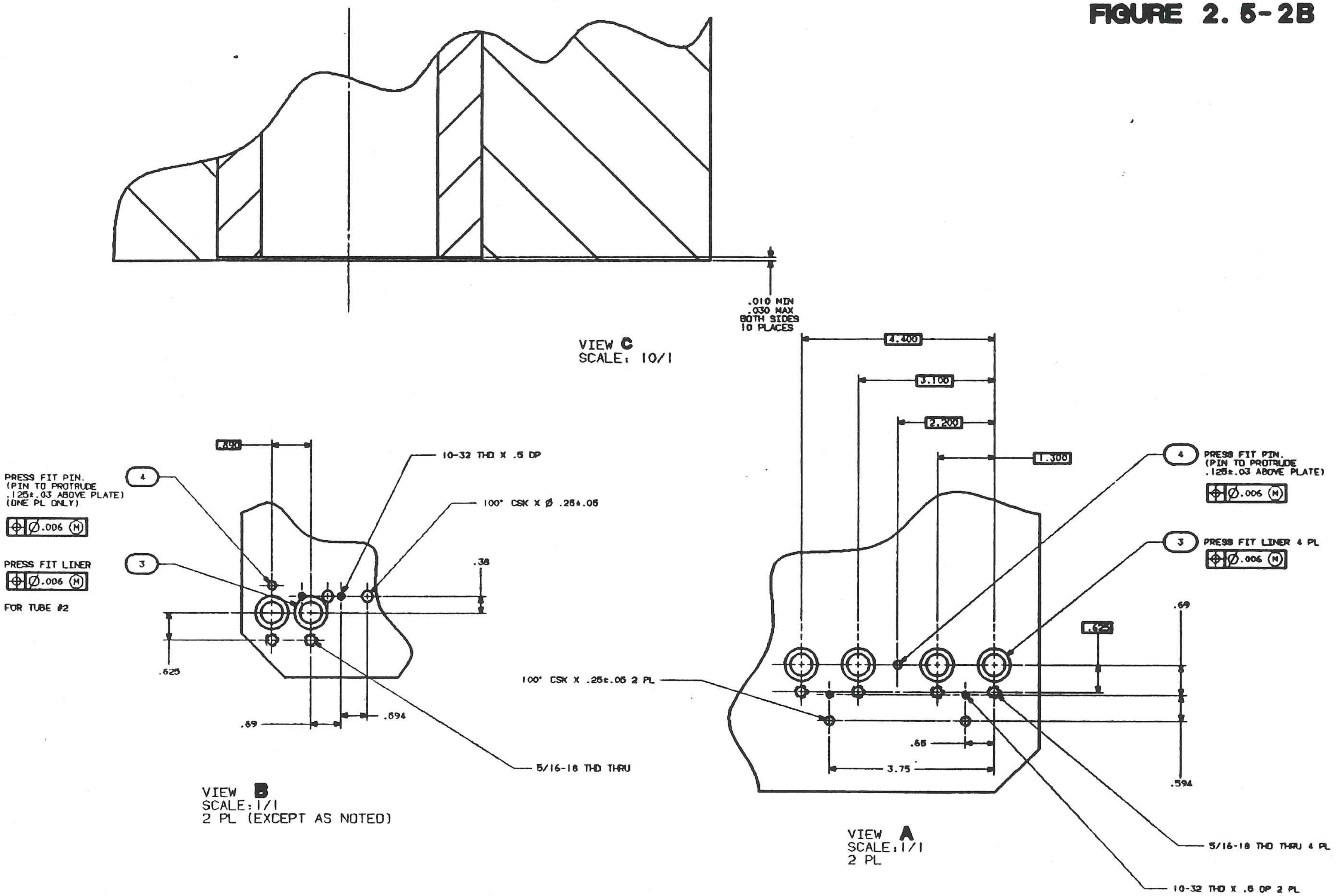
LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

PLATE-DRILL ASSY
SOLAR-A/SXT

SIZE E
FSCM 65113
DRAWING NO SXT-20011
REV A

ZONE | REV | DESCRIPTION | DATE | APVD
SEE SHEET 1 FC ONS

FIGURE 2.5-2B



FOR NOTES SEE SHEET 1.

E | 65113 | SXT-20011 | A
SH 2 OF 2

2.7 SXT Modal Characteristics -

2.7.1 SXTS Modal Properties -

The following table is for the Engineering Model SXTS and is for reference only.

The text for this section was extracted from the "ENGINEERING TEST REPORT, MODAL TESTING OF SOFT X-RAY TELESCOPE" SXT-60008 April,88.

Table 2.7-1
Soft X-Ray Telescope Measured Modes (0-1024 Hz Bandwidth)

Mode	Frequency	Damping	Mode Description
1	152.1 Hz	0.04497	Compression Z-axis, Fwd Mirror Mnt Deformation
2	178.6	0.03830	Compression Z-axis, Fwd Mirror Mnt Deformation
3	339.0	0.01518	Primary Tube Bending
4	378.3	0.03377	Complex Tube Bending
5	426.1	0.04335	Fwd Mirror Mount Local Longitudinal Flexure
6	494.3	0.03546	Tube Body Torsion
7	522.7	0.01879	Tube Ovaling
8	611.6	0.00948	Complex Bending/Torsion - Tube Body
9	787.6	0.01428	Tube Ovaling
10	846.5	0.01188	Complex Bending/Torsion - Tube Body
11	879.6	0.01906	Complex Bending/Torsion - Tube Body
12	952.1	0.01980	Complex Bending/Torsion - Tube Body

2.7.2 -Deleted -

2.8 SXT Disturbance Torques -

The dynamic disturbance to the spacecraft from SXT are from the filter wheels, the shutter and the aspect telescope door.

2.8.1 Filter Wheel -

The moment of inertia (MOI) of each wheel is approximately 4.8 x 10^-4 kg m^2 plus minus 10%. The MOI of the aft filter wheel (B) with 5 Xray filters and rings is approximately 5 x 10^-4 kg m^2. The MOI of the front filter wheel (A) with 2 Xray filters 3 glass filters and rings is approx. 5.5 x 10^-4 kg m^2. The rate of rotation is approximately 30 rpm and average angular rotation per movement is approximately 120 deg. Rotation is about the spacecraft Z-axis in either direction. Normally only one wheel will rotate at a time but simultaneous rotation in the same ~~direction~~ is possible.

either

2.8.2 Shutter -

The moment of inertia of shutter and shutter motor is 7.9 x 10^-6 kg m^2. Maximum rate is 500 rpm about the spacecraft Z-axis. Rotation may be in either direction through an angular distance of 90 or 180 deg.

2.8.3 Aspect Telescope Door -

The moment of inertia of the aspect telescope door is less than that of the shutter. The door is expected to be operated infrequently.

2.9 Magnetic Materials -

The text for this section was extracted from the United Technologies Optical Systems "CRITICAL DESIGN REVIEW PACKAGE"
See chapter 11.

Table 2.9-1
Thermomagnetic Properties of Invar with Iron content: 61 to 63%

Field Strength H, Oersteds	Normal Induction B, Gauss	Permeability U
2	300	1700
4	1600	2900
6	4000	4400
8	5600	4500
10	6500	4300

Total weight of Invar < 0.30 lbm. Dimensions of the Invar pads used to mount the mirror.

Six pads connect the mirror fingers to the mirror glass.

Pad dimensions	1.6 inch X .52 inch wide X .14 inch thick
Finger post	Dia .25 inch X .35 inch long

CHAPTER 3

THERMAL

3.1 Temperature Requirements -

The SXT experiment is housed within the SOLAR-A spacecraft as shown in Figure 2.1-1. The CCD is cooled and temperature controlled by a thermo-electric cooler (TEC), and the front and rear temperatures of the SXT instrument are controlled with feedback control heaters. The thermal interfaces and requirements of the SXT experiment are described in this section.

Table 3.1-1
Operational Mode/Thermal Interactions

Mode	Specification
Initial attitude maneuver	survival
Day time	operational
Night time	operational

Table 3.1-2
SXT Temperature Requirements

Node No.	Description	Interface ID	Temperature range (c) Operating	Functional	Survival
01	Aspect Sensor(lens)		0/+25	-10/+30	-30/+60
02	Mirror		0/+25	-10/+30	-30/+60
03	Metering Tube		0/+25	-10/+30	-30/+60
04	Metering Tube		0/+25	-10/+30	-30/+60
05	Metering Tube		0/+25	-10/+30	-30/+60
06	Metering Tube		0/+25	-10/+30	-30/+60
07	Metering Tube		0/+25	-10/+30	-30/+60
08	Filter Wheel Housing		0/+25	-10/+30	-30/+60
09	TEC Hot End		-17/+20	-25/+30	-30/+60
10	Rear Support Upper		0/+25	-10/+30	-30/+60
11	Rear Support Lower		0/+25	-10/+30	-30/+60
12	Front Support		0/+25	-10/+30	-30/+60
13	Front Support Plate		0/+25	-10/+30	-30/+60
14	Front End/Aperature	G	0/+25	-10/+30	-30/+60
15	Outer Housing Ring		0/+25	-10/+30	-30/+60
23	Metering Tube MLI	D		Not specified	
24	Metering Tube MLI	D		Not specified	
25	Metering Tube MLI	D		Not specified	
26	Metering Tube MLI	D		Not specified	
27	Metering Tube MLI	D		Not specified	
113	S/C front support I/F	A2	-	-	-
156	S/C Aft Support I/F	A1	-	-	-
155	S/C TEC I/F	F	-	-	-
	CCDE/P		-20/+40	-20/+50	-30/+60
	FDE		-20/+40	-20/+50	-30/+60
	SXTE-U		-20/+40	-20/+50	-30/+60

NOTE:

Operational range is the temperature range to assure operation. Within this temperature range, SXT can operate with nominal performance.

Functional range is the temperature range to assure degraded operation. Within this temperature range, SXT can operate with deteriorated performance. This would produce a change in image resolution and in the CCD Camera dark current floor level.

Survival range is the temperature range to assure recovery. The temperature excursion in the survival range does not cause any irreversible change in the SXT system. All the scientific instruments are switched-off in the survival range.

Electronics box temperatures

The temperatures of the CCDE/P, FDE and SXTE-U specified are the temperatures at the box principal heat rejection surface (in general this is the surface opposite the mounting flange). Each box must function for the specified range of box surface temperatures.

3.1.1 Thermal Gradients -

The thermal gradients in the X or Y direction shall not exceed 10 C.

3.1.2 TEC Requirements -

The baseline operating temperature of the CCD is -27 C. This temperature is a function of the coupling of the CCD to the TEC cold junction (a loss of approx. 2 deg.), the performance of the TEC (a gain of approx. 40 deg.), the coupling through the Thermal Strap Assembly (TSA), (a loss of 9.4 deg.), and the temperature of the spacecraft at the hot end of the TSA. This last datum about the spacecraft has not been revised yet from a value of -5.6 deg. This is the worst case orbit maximum temperature of the Normal cold data from Table 3.3-2 at the base panel. Based upon this data the baseline operating temperature should be able to be achieved. The 3-stage TEC can maintain a temperature differential of 40 C between the CCD and the TEC hot end, so the hot end temperature on the CCD camera head must not exceed +20 C. The thermal conductivity of the thermal strap assembly (TSA) which conducts heat away from the TEC hot end is 2.81 K/W, including interface losses on both ends (see Fig. 3.3-2 and Fig. 3.3-4). These straps must dissipate 3.36 watts for the worst case. Therefore, the maximum temperature at the TSA attachment point to the SXTS rear mounts is +10.6 degrees C.

1 2+5

In order to heat the CCD camera for off-gassing purposes, a Dale ARH-25 resistor will be installed on the TEC hot end of the thermal strap assembly. Heater resistance to provide 8 W is:
28x28/8W = 98 ohms.

3.2 Power Dissipation -

The average power released as thermal energy within each component of the SXT for different operating modes is presented in Table 3.2-1.

Table 3.2-1
SXT Heat Dissipation (Watts)

Component	Day Max	Day Min	Night Max	Night Min
SXTS - FPG				
Absorbed Heat	--	--	--	--
Filter motor	1.63	0.05	0.00	0.00
Shutter motor	0.04	0.00	0.00	0.00
TEC Cold End *	-0.78	-0.50	-0.78	-0.50
CCD Pre-amp	0.40	0.40	0.00	0.00
Total	1.29	-0.05	-0.78	-0.50
TEC Hot End **	3.36	2.24	3.36	2.24
SXTS-OPTICS				
Aspect Motor	0.06	0.00	0.00	0.00
SXT Boxes				
FDE	0.48	0.42	0.00	0.00
SXTE-U	1.00	1.00	1.00	1.00
CCDP	2.41	1.93	2.46	0.00
CCDE	3.21	1.99	0.00	0.00

NOTE:

Day max - visible orbit, filter operation: 2 sec cycle time
1 exposure every 2 seconds, 20 msec exposure (Flare Mode),
"warm environment for TEC cold end"

Day min - invisible orbit, fixed filter,
1 exposure every 64 seconds, 20 msec exposure (Quiet Mode),
"cool environment for TEC cold end"

Day/Night max - TEC hot end at 20 C, cold end at -20 C.

Day min - TEC hot end at 10 C, cold end at -20 C.

Night min - TEC off

*: Net cooling supplied to focal plane group by the TEC

**: TEC heat dissipation is treated separately, because it is insulated from FPG.

3.3 Thermal Interfaces -

3.3.1 SXT Instrument -

The thermal interfaces of the SXT instrument are shown schematically in Figure 3.3-1 [SXT-20006]. The interface heat transfer requirements, obtained from thermal math modelling, (see Appendix G) are given in Table 3.3-1. The instrument will be radiatively isolated by multi-layer insulation (MLI). Except for the TSA, the primary heat transfer path will be by conduction through the rear mounting feet to the spacecraft structure. The thermal strap will dump heat from the TEC to a thermal interface point "F" on the SOLAR-A spacecraft bottom base panel.

Table 3.3-1
SXT Instrument Heat Transfer

INTERFACE		AVERAGE THERMAL POWER (watts) (Avg. over 24 hour day.)
A2	Forward mounts	0.5
A1	Aft mounts	2.0
F	TEC thermal strap (TSA)	4.0
D	MLI (e* > 0.05)	2.0
G	Front End / Spacecraft I/F	0.5

3.3.2 Electronics Boxes -

The primary thermal transfer for most SXT electronic boxes shall be by radiation into the interior areas of the spacecraft.
Baseline concept is:

		Spacecraft Coupling (cm^2)
SXTE-U	- radiative	278.49
CCDE/P	- radiative	185.81
FDE	- radiative	203.05

Those boxes which are isolated from the mounting surface will have the isolation supports described next.

Isolator washers between the various electronics boxes and the spacecraft shall meet NEC criteria for thermal conductance of:
<.10 Watts/Deg K for Top flange isolation washer.
<.05 Watts/Deg K for Bottom flange isolation washer.
For washer drawing see Fig 3.3-5A,B,C.
For SXTE-U washer see Fig 2.4-6.

Box		Insulator material	Support coupling W/m/K	W/K	Outer Diam. OD mm	inner Diam. ID mm	thick-ness t mm	washer area m sq	Contact area to S/C
SXTE-U		Fiberglass	0.74	0.027	11.4	6.2	2.0	7.2E-5	7.2E-5
FDE		Fiberglass	0.74	0.018	9.5	5.3	2.0	4.9E-5	4.9E-5
CCDP/E	Top	Fiberglass	0.74	0.022	9.5	5.4	1.6	4.8E-5	N/A
CCDP/E	Bottom	Fiberglass	0.74	0.026	12.7	4.3	3.2	1.1E-4	1.1E-4

Heat transfer requirements (power levels) are given in Table 3.3-1.

3.3.3 Thermal Finish Of Electronic Boxes -

Thermally isolated boxes will be painted with Chemglaze black Poly-Urethane to achieve high emissivity surfaces (>0.8) on all sides except the mounting surface side. Mounting surface side will be taped with Acrylic Kapton V.D. Aluminum, Scotch 3M, High temperature Acrylic adhesive.
The taped surface will have an emmissivity less than 0.07.

Box	Material	Surface Finish	epsilon	alpha
SXTE-U	Al Alodyne	black paint	>/=0.8	-
		bottom taped	</=0.07	
CCDP/E	Al	black paint	>/=0.8	-
		bottom taped	</=0.07	
FDE	Magnesium Alloy	black paint	>/=0.8	-
		bottom taped	</=0.07	

3.3.4 MLI -

The MLI is made of embossed aluminized Kapton. The external emissivity, the internal effective emissivity, and the surface area are given in Appendix G, in Table G.8-1. The inner and outer layers are made of aluminized/kapton-fiberglass cloth with all layers electrically grounded. Details of the external thermal control interfaces are given in Figure 3.3-6. Those surfaces not covered by MLI are covered with either teflon/aluminum tape or aluminized polyimide tape. The figure shows which is used in what location.

The OBJ MLI will be attached to the SXT after the SXT is mounted in the spacecraft. The FPG MLI will be attached to the SXT before it is mounted to the spacecraft. The MT MLI will be attached to the SXT at delivery to ISAS. The OBJ MLI and the MT MLI are attached to the SXT using buttons that are bonded to the SXT, and rods that insert into the buttons. The rods are inserted through the MLI for retention of the MLI. The OBJ MLI and the FPG MLI are secured to the SXTS using tape. Tape is also used to secure the MT MLI against the pull of gravity when the SXT is in a vertical orientation.

3.3.5 Boundary Temperature -

Table 3.3-2 lists calculated temperature distribution of spacecraft plates surrounding SXTS on the basis of NEC Solar-A-1743 (October 27, 1989).

Table 3.3-2
SXTS Boundary Temperature

location	surface properties	Normal hot	Normal cold	Initial hot	Initial cold
Sun shade	eH = 0.8	+24.4/-19.0	+7.5/-22.3	-	-
upper center panel	eH = 0.05	+17.6/+16.5	+8.4/+7.7	-	-
lower center panel	eH = 0.05	-1.3/-2.4	-4.0/-6.5	-	-
base panel (TEC I/F)	eH = 0.05	-6.3/-8.1	-5.6/-10.6	-	-

NOTE:
T1/T2 = orbit maximum temperature/orbit minimum temperature(deg C). For average values, see Appendix G, Table 6.6-1.

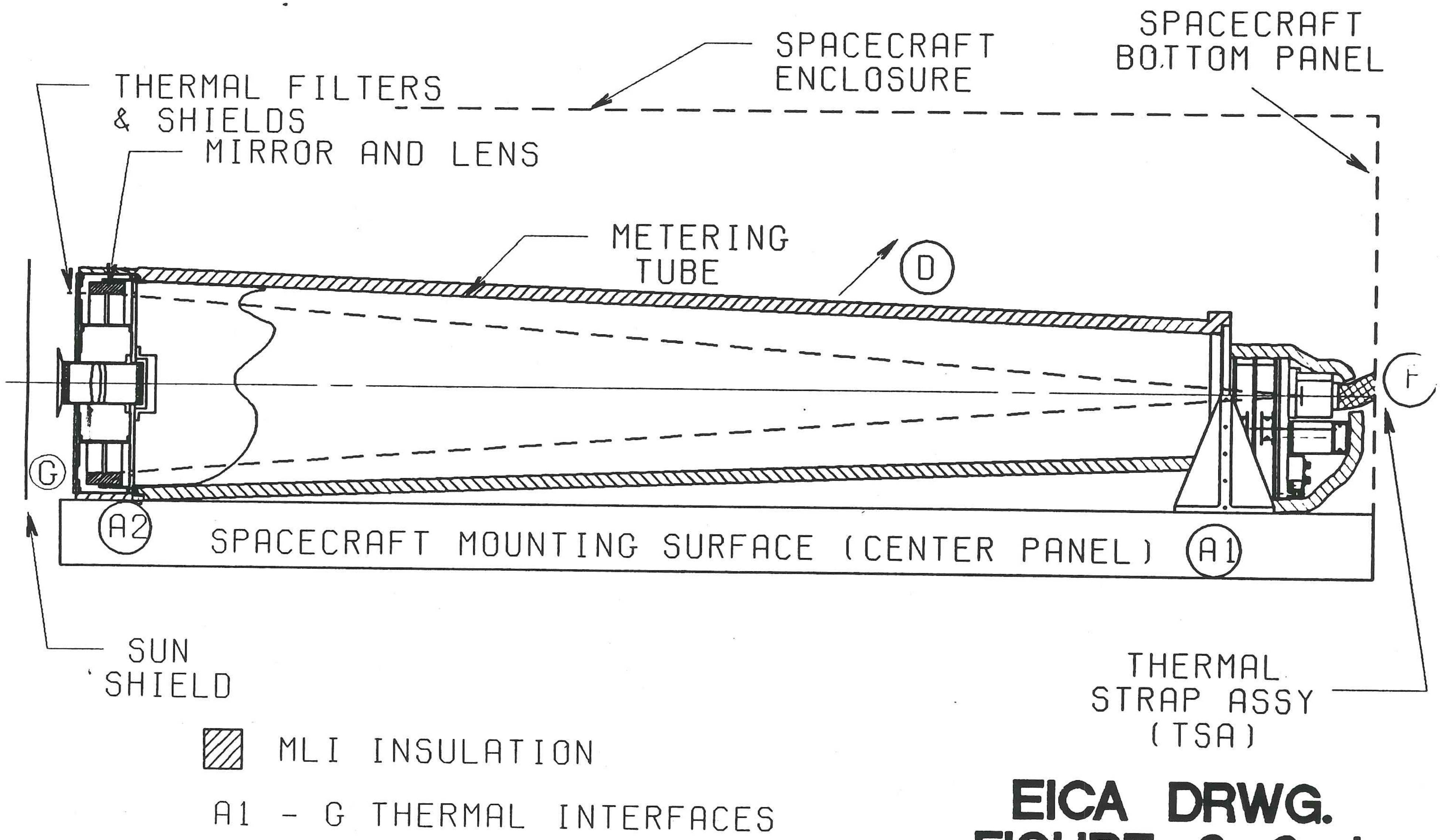
3.4 Thermal Math Model -

A 20-node thermal math model of the SXT Instrument is provided in EICA Appendix G.

3.5 Thermal Interface To Space -

The forward end of the SXT instrument does not extend beyond the skin of the SOLAR-A spacecraft.

The thermal closeout between the SXT and the spacecraft (sun shield) is shown in Figure 3.5-1. The thermal surface treatment is shown in Figure 3.5-1.



EICA DRWG.
FIGURE 3.3-1

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD
	A	REMOVED NOTE 3. IN ITEM 3 SXT-2EC85 WAS SXT-2EC82. ADDED MATERIAL SPECS TO ITEMS 4 & 5. KEPT ONLY PROFILE OF CCD HEAD.	18JAN90	KFG
C6 D7 A7 B2	B	UPDATED ITEM # 2. REF SXT-2EC81 REV-A. ADDED MARKER FOR NOTE 2. UPDATED NOTE 2. ADDED ITEM # 6.	25APR90	KFG

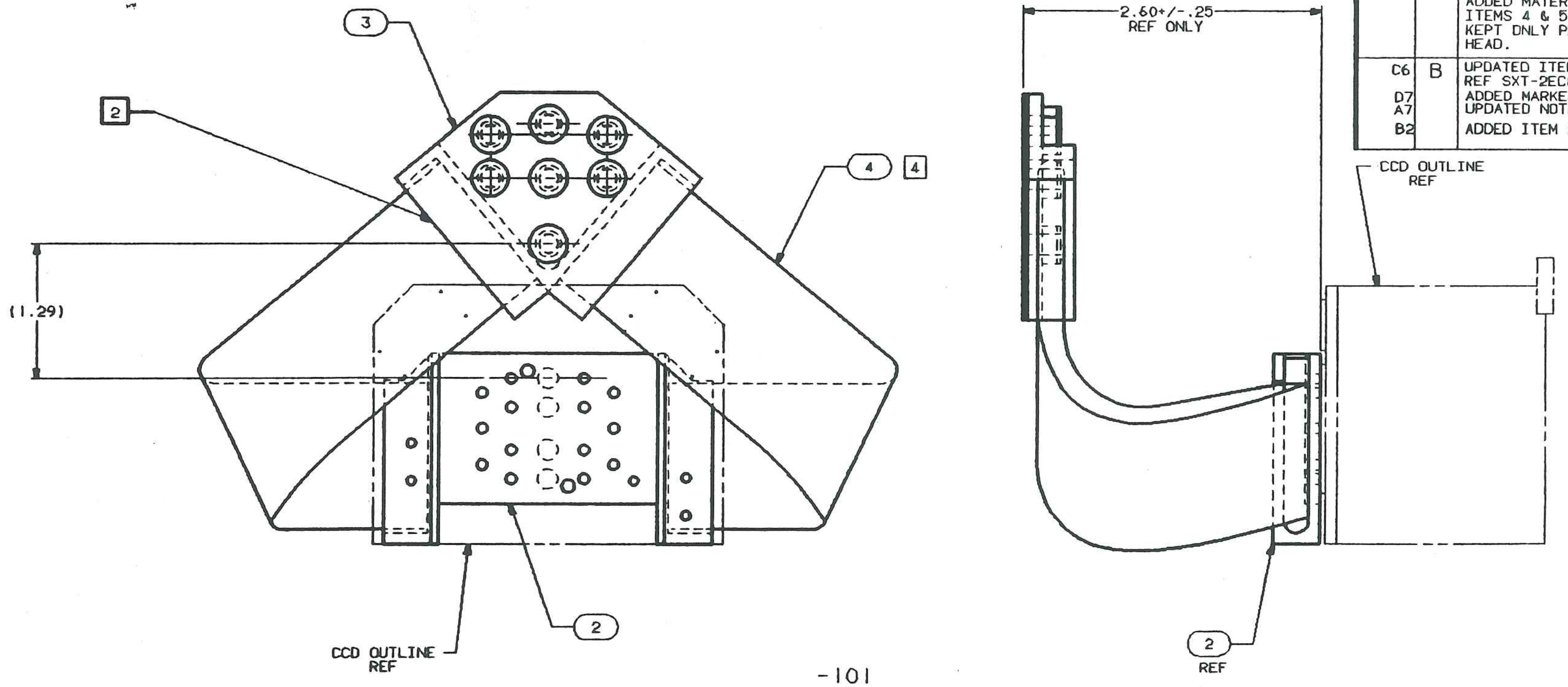


FIGURE 3. 3-2

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. PROTECT AND HANDLE PER LAC 1001.

$\boxed{2}$ USING ASSEMBLY FIXTURE, ITEM # 6. SOLDER THE ENDS OF ITEM 4 TO ITEMS 2 & 3. USING ITEM NUMBER 5. SOLDER MASK ITEM 3 IN ORDER THAT THE CABLES DOE NOT HAVE SOLDER OUTSIDE OF THE POCKETS IN ITEMS 1 & 2.

3. VACUUM BAKE OUT FOR 2 HOURS AT 200 ° F.

$\boxed{4}$ CABLE LENGTH IS APPROX. 5.0 +/-.5 INCH.

OLD EM # WAS
SXT-25C60

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO
1		SXT-2EC88	ASSEMBLY FIXTURE				6
AR		WRMAP-3	KESTER SOLDER	ALLOY SN 63 FLUX 282 $\boxed{2}$	QQ-S571E		5
2		BELDEN CABLE #5016	CABLE, THERMAL SHORT	WIRE 1-1/2 INCH WIDE $\boxed{4}$	1680 WIRES 30 AWG BARE COPPER		4
1		SXT-2EC85	BULKHEAD CAPTURE BLOCK ASSEMBLY				3
1		SXT-2EC81	CAPTURE BLOCK THERMAL SHORT				2
—		-101	THERMAL STRAP ASSEMBLY				1

PARTS LIST

SXT-2D028	SOLAR-A
NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON.
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG,30 MIN
CONTR NAS8-37334

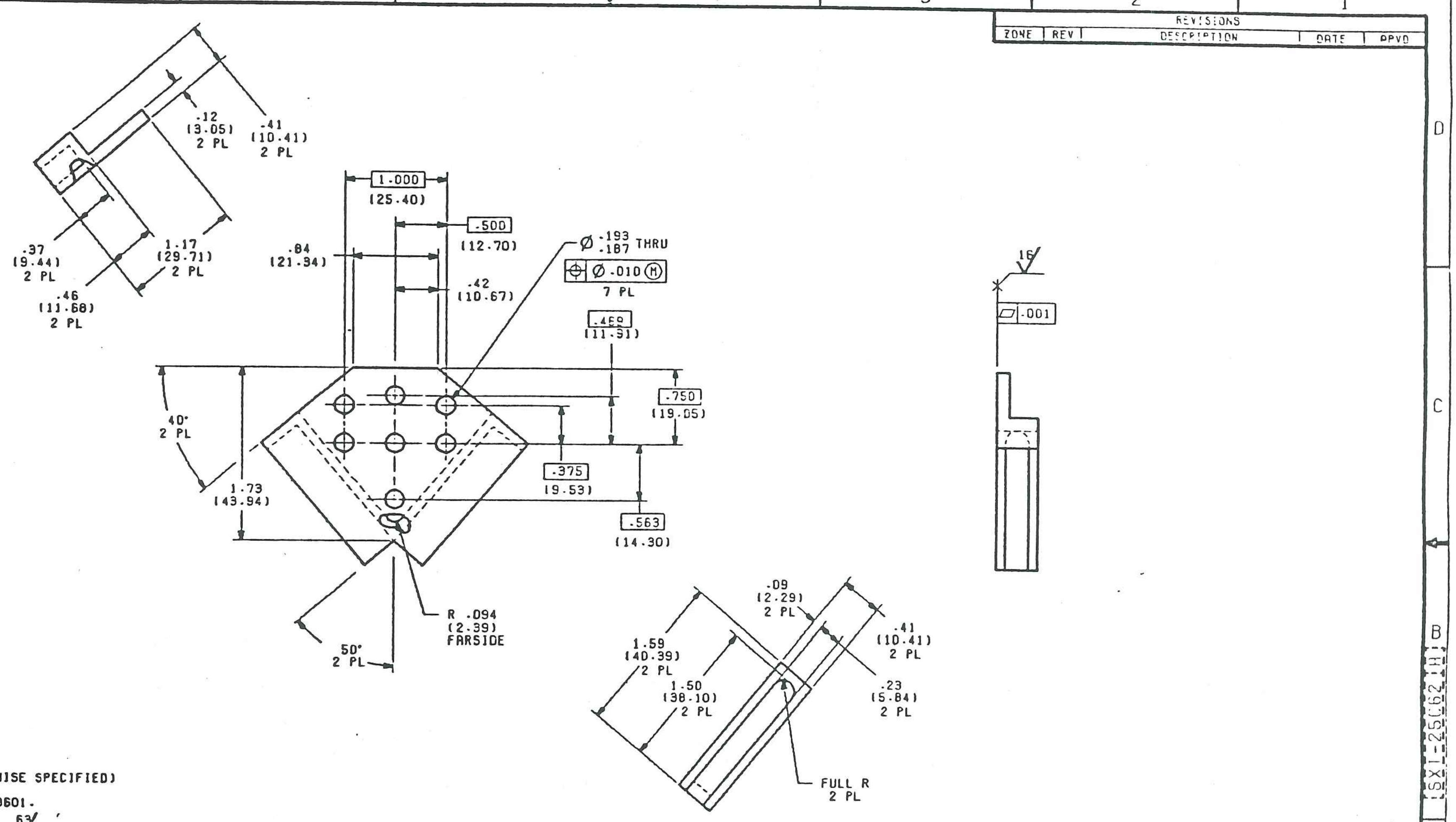
DATE 88-29-02
DWN A. THOMAS
APVD J. VIEIRA
APVD K. GOWEN
ENGRG B.K. JURCEVICH
CHKR J. VIEIRA
APVD M. FINCH
APVD G. GRADWOHL

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

THERMAL STRAP
ASSEMBLY

SIZE	FSCM	DRAWING NO	REV
D	65113	SXT-2EC80	B

Figure 3.3-3 - Capture Block Thermal Short - Deleted.



NOTES:(UNLESS OTHERWISE SPECIFIED)

1. MACHINE PER LAC 3601.
2. SURFACE ROUGHNESS $\sqrt{63}$.
3. BREAK SHARP EDGES .005 MIN. .015 MAX.
4. FILLET RADII .015 MAX.
5. CLEAN PER LAC 0170-000000.
6. MARK PART NO. PER LAC 3575-011998.
7. PROTECT AND HANDLE PER LAC 1001.
8. INTERPRET DIMENSIONS & TOLERANCES PER ANSI Y14.5M-1982.
9. ALL DIMENSIONS ARE IN INCHES & (MILIMETERS).

—		-101	BULKHEAD CAPTURE BLOCK	.500 COPPER FULL HARD	OFHC FULL HARD		—
QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG.30 MIN

DATE 88-11-03
DWN A. THOMAS
APVD JOHN VIEIRA
APVD
ENGRG B.K. JURCEVICH
CHKR
APVD
APVD
CONTR
SCA/CI

25C60 NEXT ASSY
SOLAR-A USED ON
APPLICATION

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

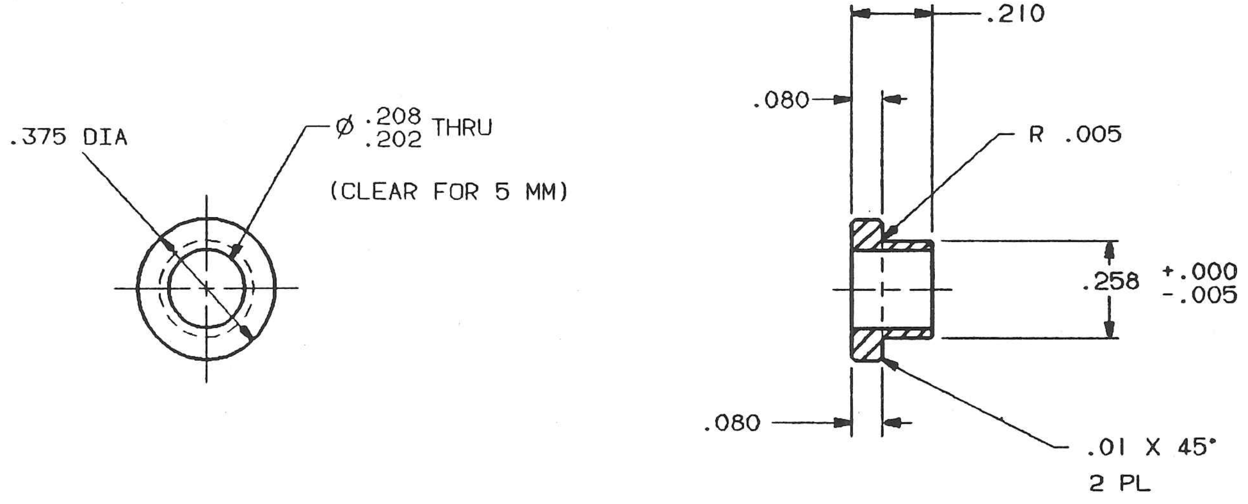
BULKHEAD CAPTURE BLOCK

SIZE D
FSCM 65113
DRAWING NO SXT-25C62
REV A
SCALE
SH 1 OF 1

Figure 3.3-4 [SXT-25C62] Bulkhead Capture Block

REVISIONS				
ZONE	REV	DESCRIPTION	D	APVD
C3	A	INCR INSIDE DIA FOR 5 MM	3MAY90	BKJ

FIGURE 3. 3-5A
P. 3-12



NOTES: (UNLESS OTHERWISE NOTED)

1. MACHINE PER LAC 3601.
2. MARK PART NO. PER LAC 3575-011998.
3. PROTECT AND HANDLE PER LAC 1001.
4. ~~SURFACE ROUGHNESS~~ 63
5. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982.

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO
-		-101	WASHER	1/2 DIA ROD FIBERGLASS	NEMA-G10		-

PARTS LIST

NEXT ASSY	USED ON
2D044	SOLAR-A

APPLICATION

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .015
.XXX = ± .010
ANGLES = ± 0 DEG.30MIN
CONTR NAS8-37334
CCA/CI

DATE 89-01-20
DWN B.K.JURCEVICH
APVD J. VIEIRA
APVD M. BRUNER
ENGRG B.K.JURCEVICH
CHKR J. VIEIRA
APVD G.GRADWOHL
APVD M.FINCH

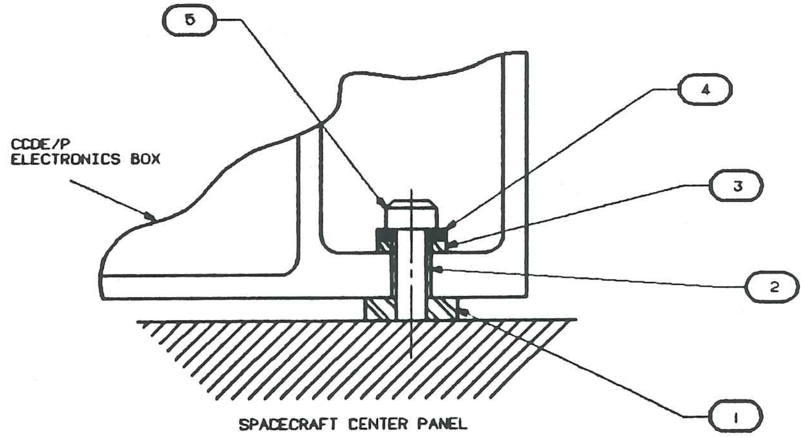
LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

WASHER,
FDE THERMAL ISOLATION
SOLAR-A/SXT

SIZE	FSCM	DRAWING NO	REV
C	65113	SXT-2D025	A
SCALE 4/1		SH 1 OF 1	

SXT-2D02

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APVD



PARTS LIST

ITEM NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	INSIDE DIAMETER	OUTSIDE DIAMETER	LENGTH/ THICKNESS	QTY REQD
1	BOTTOM WASHER	G10 FIBERGLASS	.169 IN	.500 IN	.125 IN	4
2	SCREW INSULATOR	VESPEL SP-1	.172 IN	.210 IN	.275 IN	4
3	TOP WASHER	G10 FIBERGLASS	.213 IN	.375 IN	.064 IN	4
4	FLAT WASHER	STEEL	.169 IN	.375 IN	.064 IN	4
5	4 MM SCREW	PROVIDED BY J SIDE				4
6						

FIGURE 3. 3-5B
P. 3-13

NOTES:

ECA REF DWG. NOT FOR MFG

SOLAR-A

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG, 30 MIN
CONTR NAS8-37334

DATE 90-05-24
DWN B.K. JURCEVICH
APVD J.R. VIEIRA
APVD M.E. BRUNER
ENGRG B.K. JURCEVICH
CHKR J.R. VIEIRA
APVD G. GRADWOHL

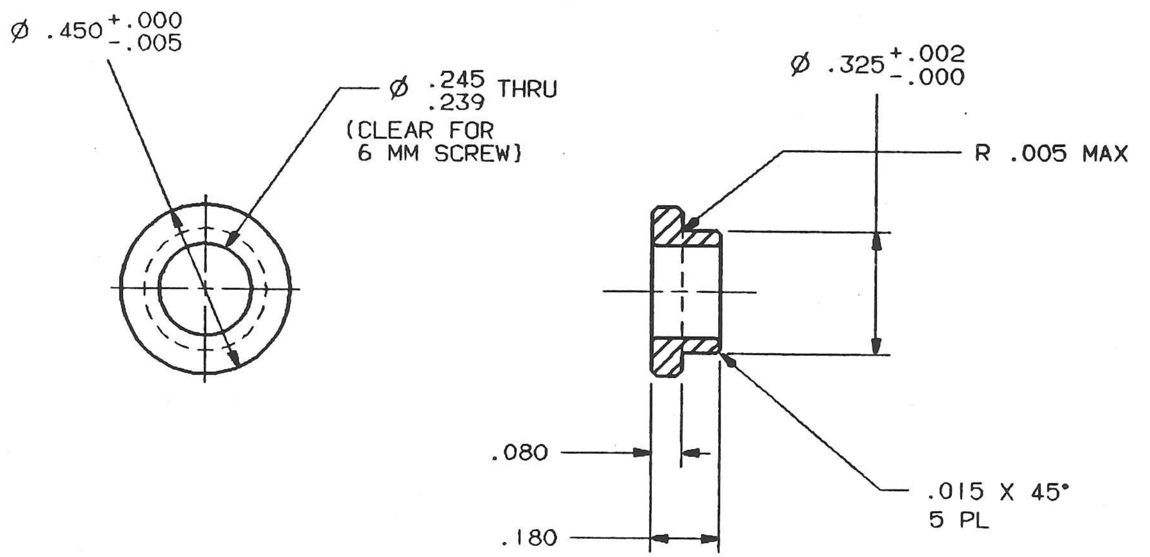
LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

CCDE/P INSULATOR
JPL DESIGN
SOLAR-A/SXT

SIZE	FSCM	DRAWING NO	REV
D	65113	SXT-2D090	-

FIGURE 3.3-5C
P. 3-14

REVISIONS				
ZONE	REV	DESCRIPTION	D/	APVD
C3	A	INCR. DIA FOR 6 MM SCREW	MAY 90	BKJ



NOTES: (UNLESS OTHERWISE NOTED)

1. MACHINE PER LAC 3601.
2. MARK PART NO. PER LAC 3575-011998.
3. PROTECT AND HANDLE PER LAC 1001.
4. SURFACE ROUGHNESS 63 ✓.
5. INTERPRET DIMENSIONS AND TOLERANCES PER ANSI Y14.5M-1982.

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO
-		-101	WASHER	1/2 DIA ROD FIBERGLASS	NEMA-G10		-

PARTS LIST

NEXT ASSY	USED ON
2E066	SOLAR-A

APPLICATION

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG.30MIN
CONTR NAS8-37334
CCA/CI

DATE 89-01-20
DWN B.K.JURCEVICH
APVD J. VIEIRA
APVD M. BRUNER
ENGRG B.K.JURCEVICH
CHKR J. VIEIRA
APVD G. GRADWOHL
APVD M.FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

WASHER,
SXTEU THERM ISOLATION
SOLAR-A/SXT

SIZE	FSCM	DRAWING NO	REV
C	65113	SXT-2D080	A

SCALE 4/1
SH 1 OF 1

SXT-2D080 A

NOTE NLESS OTHERWISE NOTED)

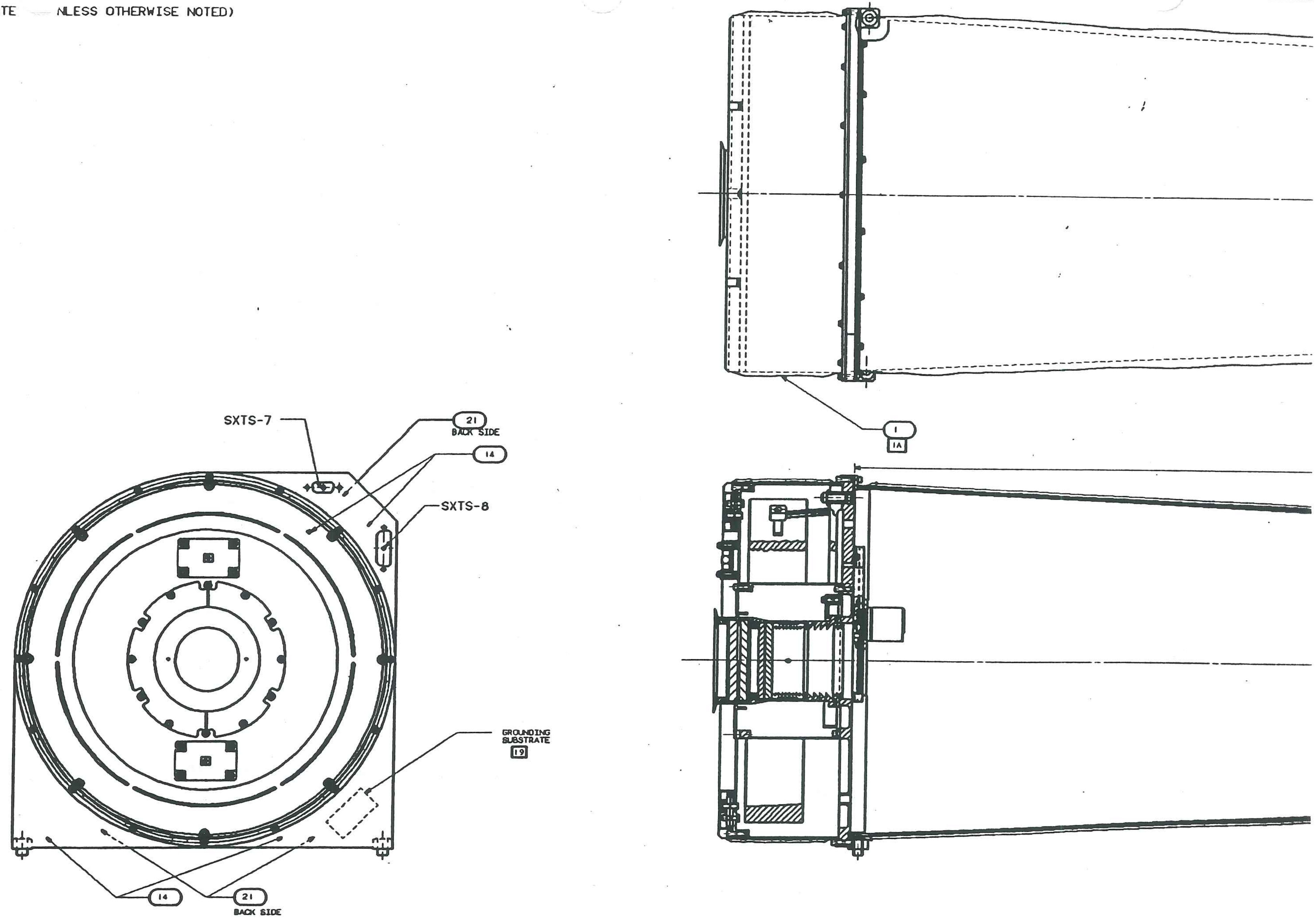


Figure 3.3-6A (SXT-2M014) SXT Thermal Interface Control - OBJ area

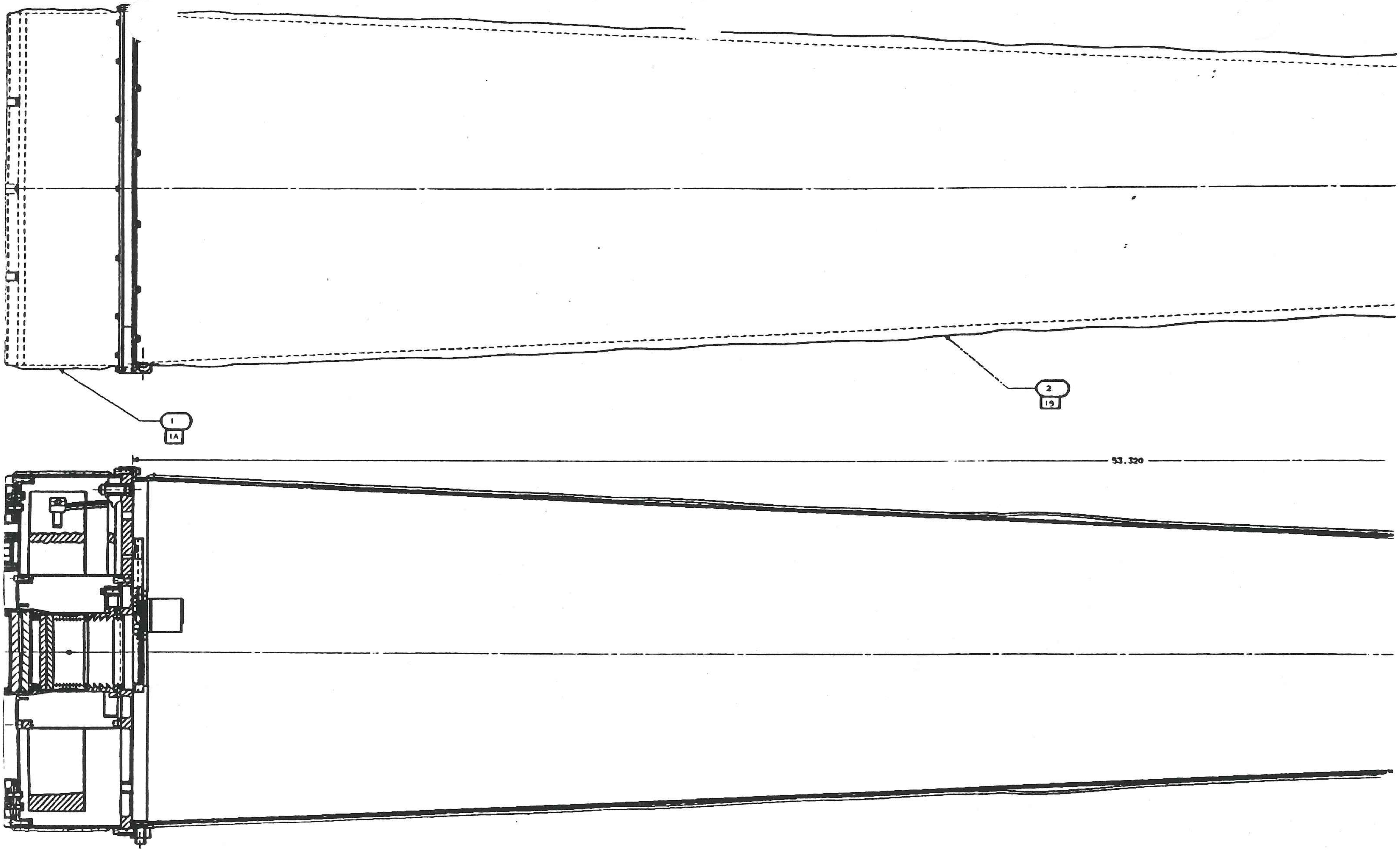


Figure 3,3-6B (SXT-2M014) SXT Thermal Interface Control [illegible] MT area.

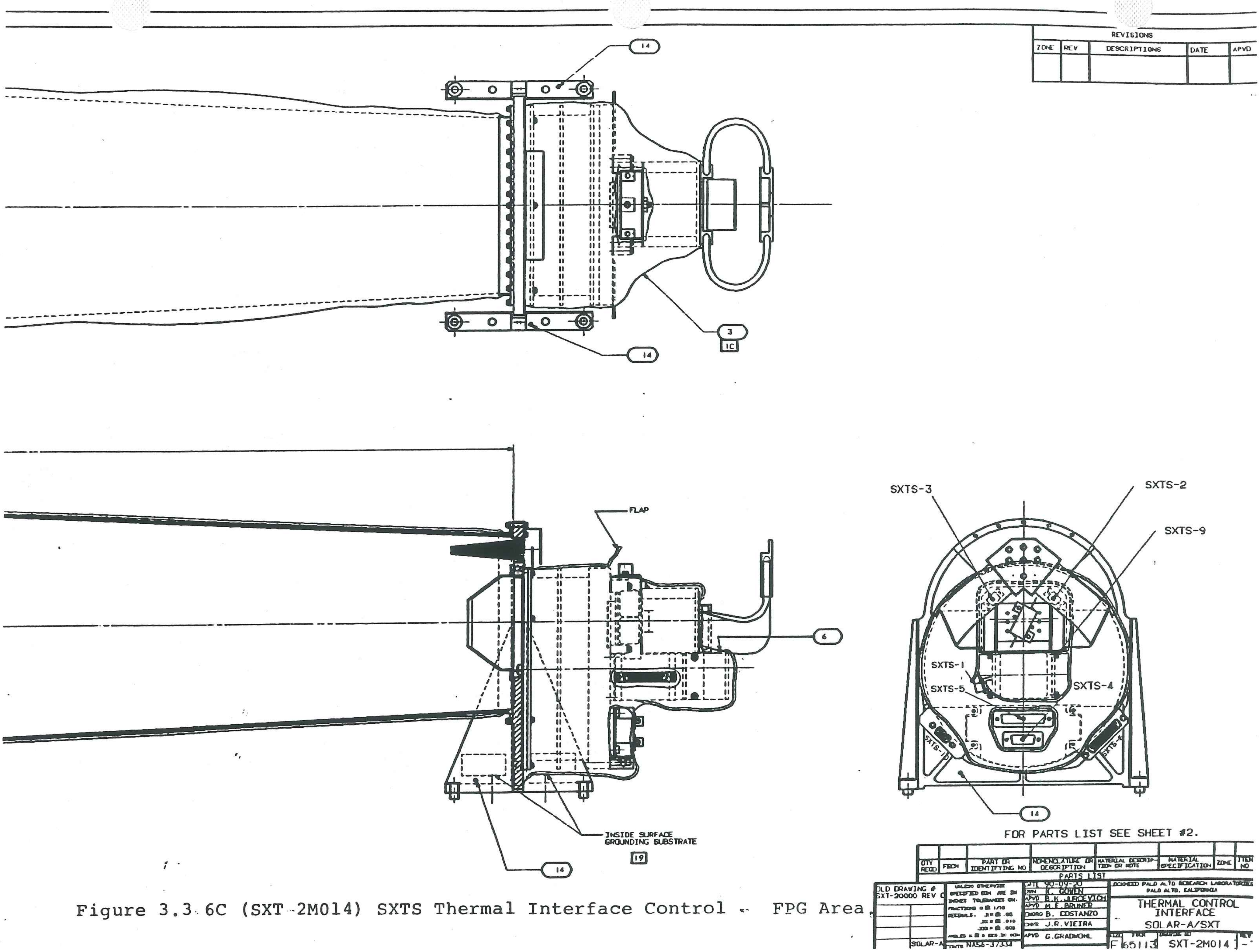


Figure 3.3.6C (SXT-2M014) SXTS Thermal Interface Control - FPG Area

NOTES

1A THE OUTER COVERING IS ITEM 13. THE TOTAL NUMBER OF METALIZED SHEETS BELOW ITEM 13 IS 10. THE 10 LAYERS ARE ITEM 17. THE INNER MOST LAYER IS ITEM 13.

1B THE OUTER COVERING IS ITEM 5. THE TOTAL NUMBER OF METALIZED SHEETS BELOW ITEM 5 IS 22. THE 22 LAYERS ARE ITEM 17.

1C THE OUTER COVERING IS ITEM 13. THE TOTAL NUMBER OF METALIZED SHEETS BELOW ITEM 13 IS 10. THE 10 LAYERS ARE ITEM 17. THE INNER MOST LAYER IS ITEM 13.

13. HANDLE WITH GLOVES. DO NOT USE SOLVENTS OR WATER ON BLANKET ASSEMBLY. FINGER PRINTS ARE TO BE AVOIDED.

15 COVER EXPOSED SURFACES WITH ITEM 14,21 OR 6 AS PER DRAWING.

17 LAMART INC., CLIFTON, NJ

19 AREA TO BE LEFT FREE OF ITEM 14 FOR GROUND STRAP ATTACHMENT. APPROXIMATELY 1-1/2 X 3/4 IN. TAPE OVER GROUNDNG LOCATION WITH ITEM 15.

ALPHA = 0.12 +/-.04 BEGINNING OF MISSION.
= 0.19 +/-.04 END OF MISSION
EPSILON = 0.80 +/-.04
ITEM # 14

ALPHA = 0.12 +/-.04 BEGINNING OF MISSION.
= 0.14 +/-.04 END OF MISSION
EPSILON = 0.04 +/-.04
ITEMS
21,13,6,5

QTY REQD	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	FIND NO
AR		24-3040330837	TAPE	ALUMINIZED POLYIMIDE	LAC-24-4498		21
1		SXT-2A011	OUTER RING HOUSING				20
1		SXT-2C001	METERING TUBE	FIBERTEK			19
AR		30-068-0010926	EPOXY/RESIN SYSTEM	3M-EC2216	WS 3309		18
AR		22-348-0072116	EMBOSSED DOUBLE KAPTON	EDAK	LAC 22-4413 -7610		17
AR		24-221-0201830	TAPE, TRANS ADHESIVE		LAC 24-4465B(1)		16
AR	17	892-L	TAPE	ALUM. COND ADHESIVE			15
AR		42-2010001184	MIRROR,TAPE	TEFLON/ ALUMINUM			14
AR		22-343-1236842	FILM	GLASS FABRIC AL POLYIMIDE	LAC 22-4448D		13
AR		24-232-0100397	TAPE	GLASS FABRIC AL POLYIMIDE	LAC 24-4687B		12
AR		24-221-0101830	TAPE, TRANS ADHESIVE		LAC 24-4465B(1)		11
AR		25-204-0010834	THREAD, WHITE	POLYESTER	VT-285(D)		10
AR		24-222-0100587	TAPE	POLYIMIDE ACRYLIC	LAC 24-4450F		9
AR			ROD	TEFLON FEP .032 DIA	AMS3556		8
AR		22-304-0050154	SHEET	TEFLON TFE, .010 THK	LAC 22-4125B		7
AR		24-304-0010319	TAPE	ALUMINIZED POLYIMIDE	LAC 24-4498D		6
AR		22-348-0045551	FILM	ALUMINIZED POLYIMIDE	LAC 22-4413 -2610		5
AR		SXT-2M008	ALUM BUTTON RETAINER	.375 ROUND 6061-T6 AL	QQ-A-225		4
1		SXT-2M004-1C	FPG BLKT				3
1		SXT-2M004-1B	METERING TUBE BLKT				2
1		SXT-2M004-1A	OBJ BLKT				1
-101		MLI BLANKET ASSEMBLY					-

PARTS LIST

REVISION STATUS OF SHEETS	REV	-	-	-	-	-
	SHEET	1	2	3	4	5

NEXT ASSY	USED ON
SXT/ 2M003	SOLAR-A

APPLICATION

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .1
.XX = ± .03
.XXX = ± .010
ANGLES = ± 2 DEG.

CONTR NAS8-37334

CCA/CI

DATE 90-09-20
DWN K. GOWEN
APVD M. BRUNER
APVD B. JURCEVICH
ENGRG B. COSTANZO
CHKR J. VIEIRA
APVD G. GRADWOHL
APVD M. FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORY
PALO ALTO, CALIFORNIA

THERMAL CONTROL
INTERFACE
SOLAR-A/SXT

SIZE	FSCM	DRAWING NO	REV
E	65113	SXT-2M014	-

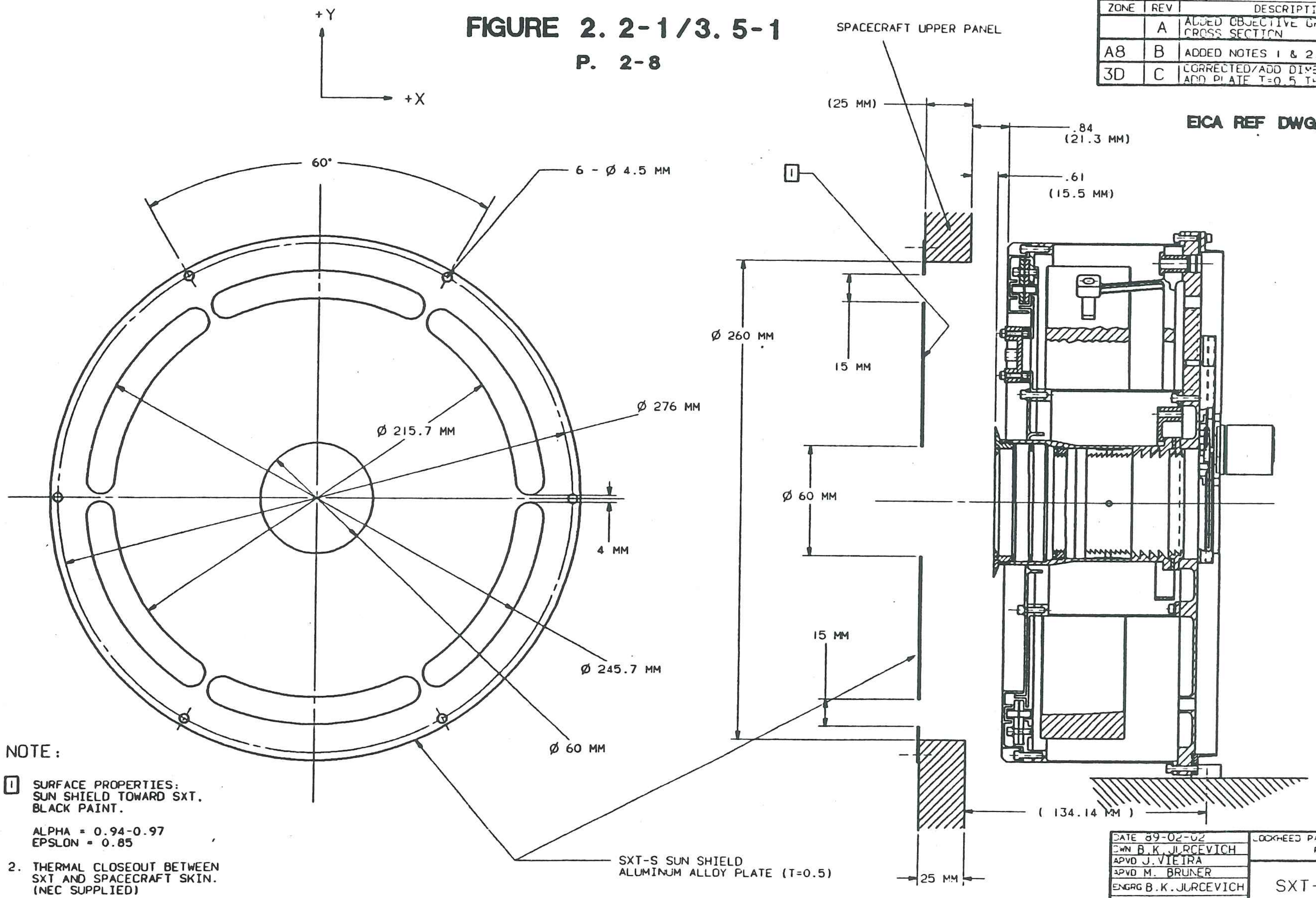
SCALE :NONE
SH 2 OF 2

SXT-2M014

Figure 3.3-6D (SXT-2D014) SXTS Thermal Interface Control - Materials and notes.

FIGURE 2. 2-1/3. 5-1

P. 2-8



NOTE:

1. SURFACE PROPERTIES:
   SUN SHIELD TOWARD SXT,
   BLACK PAINT.

   ALPHA = 0.94-0.97
   EPSLON = 0.85

2. THERMAL CLOSEOUT BETWEEN
   SXT AND SPACECRAFT SKIN.
   (NEC SUPPLIED)

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APVD
	A	ADDED OBJECTIVE GROUP CROSS SECTION	89-7-12	KFG BKJ
A8	B	ADDED NOTES 1 & 2.	90-5-21	KFG
3D	C	CORRECTED/ADD DIMENSIONS ADD PLATE T=0.5 THICK	90-8-29	BKJ

EICA REF DWG, NOT FOR MFG

DATE 89-02-02
DWN B.K. JURCEVICH
APVD J. VIEIRA
APVD M. BRUNER
ENGRG B.K. JURCEVICH
CHKR J. VIEIRA
APVD M. FINCH
APVD G. GRADWOHL

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

SXT-S SUN SHIELD

SIZE	FSCM	DRAWING NO	REV
D	65113	SXT-2A029	C

SCALE 1/1
SH 1 OF 1

Figure 3.5-2 - [SXT-2D046] Shutter Motor - Deleted.

CHAPTER 4

ELECTRICAL

4.1 Electrical Power And Energy -

4.1.1 Spacecraft Electrical Power -

Subsystems utilizing spacecraft power must have Inrush current limiting. The maximum rush current must be less than the sum of the average steady current plus 1.4 Ampere.
There are two categories of power supply (PS). Subsystems utilizing these PS's must be designed according to the following specifications:

4.1.1.1 Primary (1ry) PS Or BUS Line. -

Line voltage: stabilized Direct Current; +28 +/- 0.28 V
Dynamic impedance: less than 0.2 ohms for Direct Current to 1.0 KHz
Ripple and noise: less than 100 mV (p-p) below 10 MHz

4.1.1.2 Secondary (2ry) PS Or Converter (CNV) Output. -

Table 4.1-1
2ry PS (CNV outputs)

Volt	Voltage Range*	Remarks
+ 5V	+ 4.9 to + 5.5V	
+15V	+14.5 to +15.3V	For relay drive

NOTE:
* Including variation due to excursions of temperature and load.

Direct Current to Direct Current converter frequency: 40 KHz +/- 20%
Dynamic impedance: 0.4 to 1.6 ohms (10 hz to 100 khz)
Ripple and noise: <50 mv p-p ripple, <100 mv p-p noise

4.1.2 SXT Electrical Power -

4.1.2.1 SXT Power Usage -

Table 4.1-2
SXT Power Usage (Watts)

	Day Mode				Night Mode				
	Max		Min		Max		Min		
	28V	5V	28V	5V	28V	5V	28V	5V	REMARKS
SXTE-U	-	1.00	-	1.00	-	1.00	-	1.00	
SDE/Motor	0.034	0.003	0.001	0.000	off	off	off	off	4ms open 4ms cls
ADE/Motor(4)	0.055	0.001	0.00	0.000	off	off	off	off	.26 s open/cls
FDE Motors	1.56	0.07	0.049	0.002	off	-	off	-	120 deg move 1
FDE Box (5)	0.48	0.00	0.42	0.00					wheels .56 sec
CCDP (1)	2.41	-	1.93	-	2.46	-	off	off	@20 deg C
CCDE (1)	3.21	-	1.99	-	off	-	off	off	4 full fr. flush
CCDH	0.40	-	0.40	-	off	-	Off	off	
TEC (2)(3)	2.58	-	1.74	-	2.58	-	off	off	
Total	10.693	1.074	6.530	1.002	5.04	1.00	-	1.00	

Max day - 1 exposure every 2 sec. 20 msec exp (flare mode)
Min day - 1 exposure every 64 sec. 20 msec exp (quiet mode)
(1). Estimated power as shown in ICD minus TEC power. Assume 72% P.S. efficiency
(2). Measured-PM in thermal vacuum test @JPL
(3). Day mode Max 20 C/-20 C
Day mode Min 10 C/-20 C
(4). Operating approx once per min.
(5). FDE box quiescent power is 0.168W

Table 4.1-3
SXT Peak Operation Current

	28V	duration	5V	duration
SXTE-U				
Processor	0 mA		220 mA	-
SDE/Motor (1) open	320 mA	4 ms	80 mA	120 ms
closed	320 mA	4 ms	30 mA	-
ADE/Motor (6)	450 mA	0.26 s	130 mA	0.1 s
(7)			10 mA	-
FDE/Motors (2)(6)	600 mA	0.84 s	100 mA	0.82 s
(7)	7 mA	-		
CCD-P+E+H (3)(4)	224 mA	25 ms	0	
CCD-P+E+H (5)	220 mA	-		
CCDP (5)	110 mA	-		
TEC	92 mA	-		

Note:
1. Shutter measurement is a dwell exposure.
2. Filter measurement is for two wheels moving 180 degrees.
3. CCD camera measurement is for one flush.
4. JPL Thermal Vac measurements.
5. From JPL ICD estimated power.
6. Motor on.
7. Motor off.

4.1.3 SXT Electrical Harness And Connectors -

4.1.3.1 Harness Diagram -

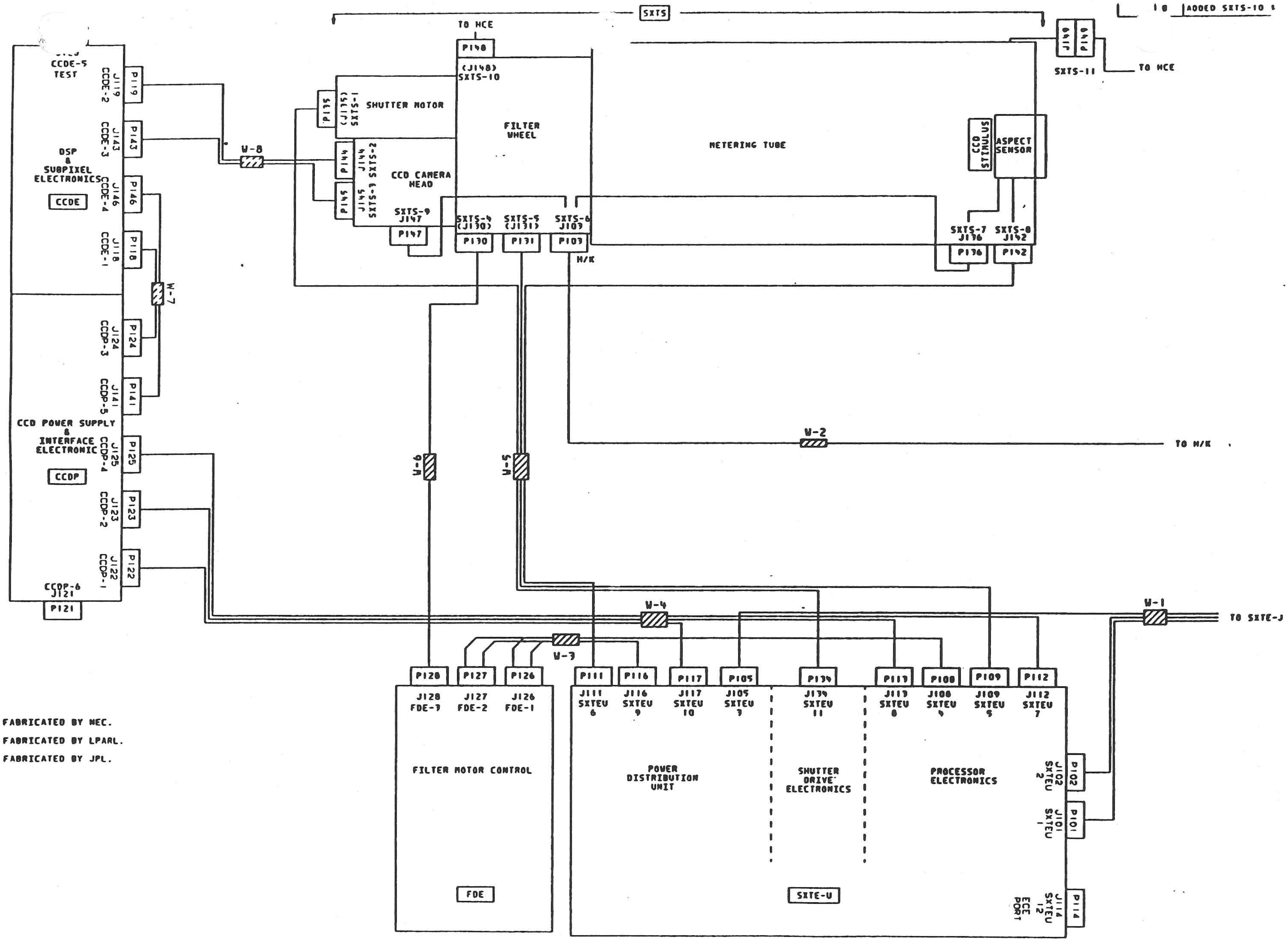
The wiring harness for SXT is show in Figure 4.1-1 [SXT 2E023] and specific cables within it are listed in Table 4.1-4.

4.1.3.2 Cable Responsibility -

Responsibility for specific cables within the SXT wiring harness are shown in Figure 4.1-1 [SXT 2E023] and listed in Table 4.1-4.

4.1.3.3 Connectors -

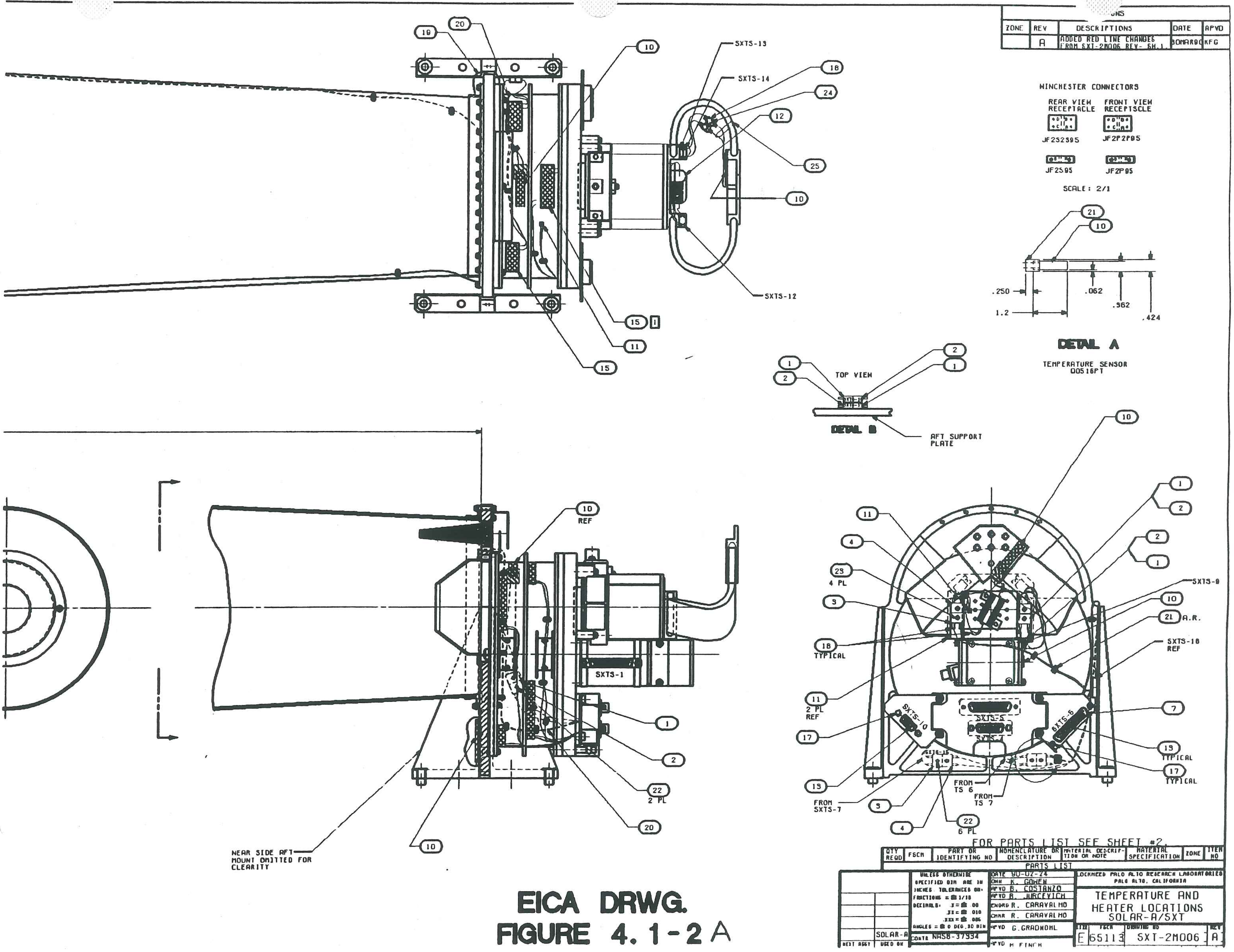
Table 4.1-4 shows the flight connectors that U.S. side will supply to ISAS/NAOJ/ IAUT for use on the SXT experiment. Spare connectors will be retained by U.S. side. All the connectors are gold-plated, and are of non-magnetic type body material.



NOTE:

1. ▨ FABRICATED BY NEC.
2. ▩ FABRICATED BY LPARL.
3. ▧ FABRICATED BY JPL.

Figure 4.1 - 1 [SXT 2E023]
Wiring Harness For SXT FM



EICA DRWG.
FIGURE 4.1-2A

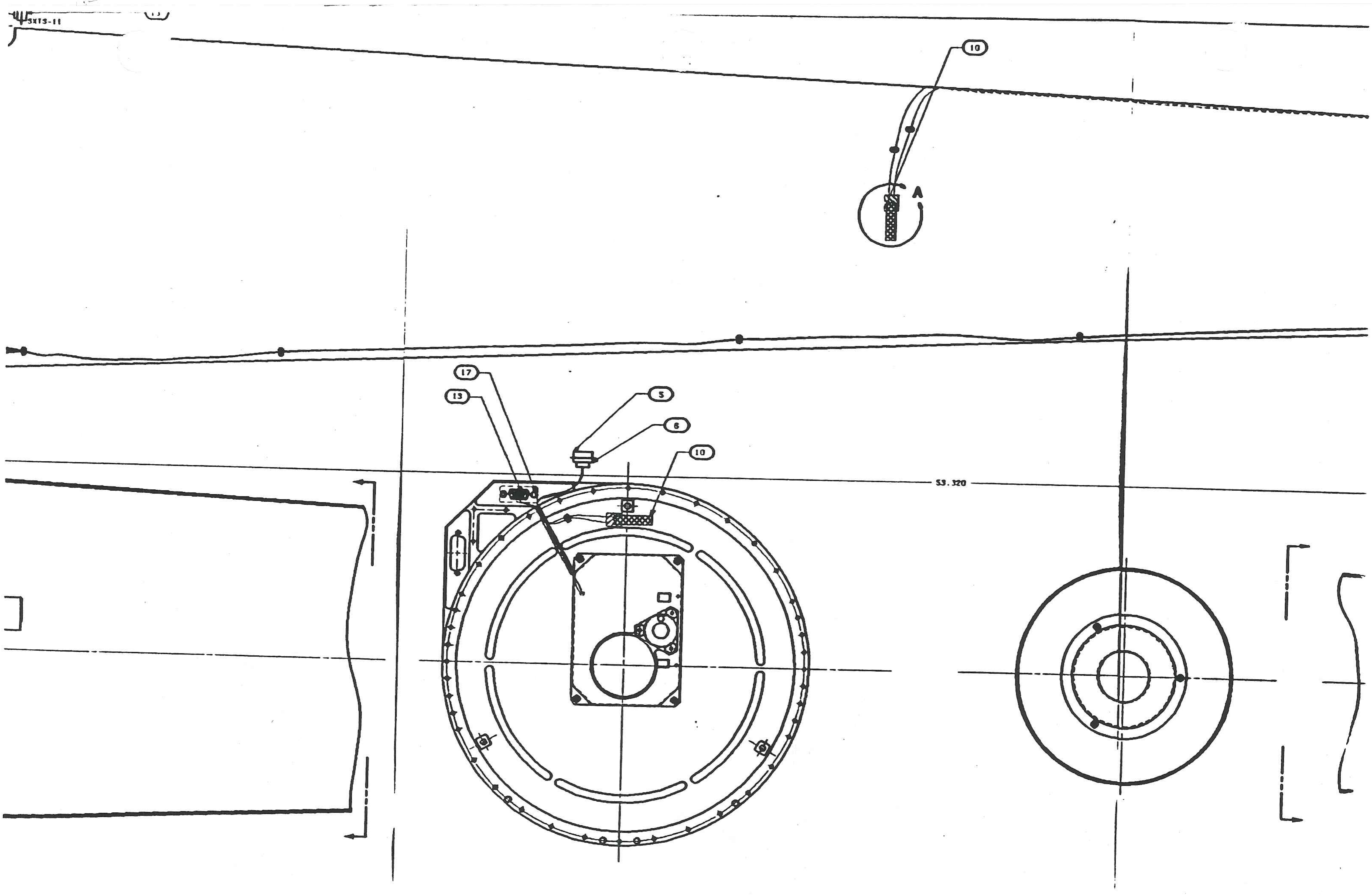


Figure 4.1-2B (SXT-2M006) Temperature & Heater Locations - Sht 2

NOTES: (UNLESS OTHERWISE NOTED)

1. INSTALL ITEM 14 CLOCKED BETWEEN ITEM 13 PER SXT-20047.
2. LEADS ROUTED TO SXTS-11.
3. INSTALL AND TORQUE ALL FASTENERS PER LAC 3600.
4. INSTALL HEATERS PER SXT-20068.

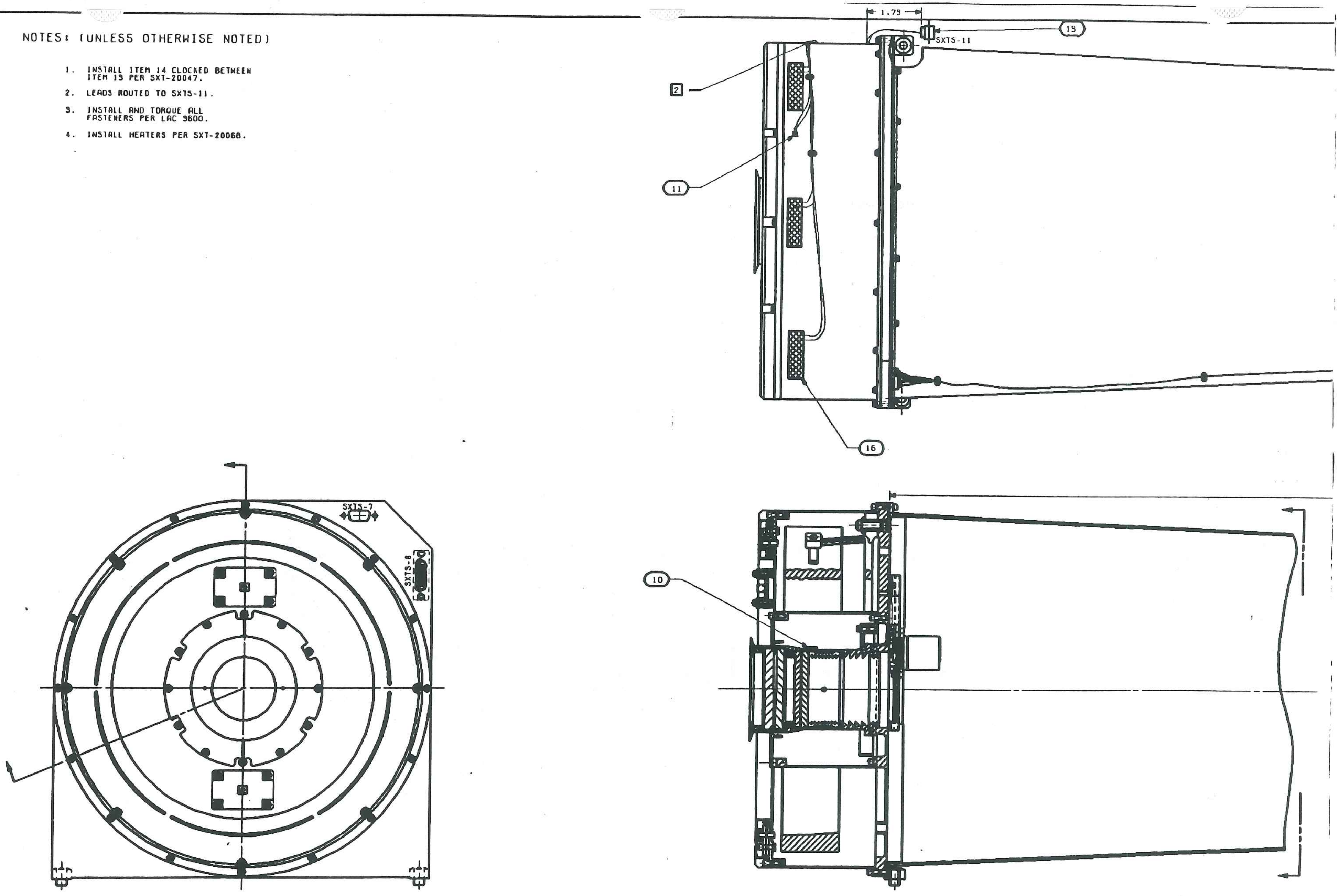


Figure 4.1-2C (SXT-2M006) Temperature & Heater Locations - Sheet 3

HEATER AND TEMPERATURE LOCATIONS
PARTS LIST

ITEM NO	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	QTY REQD
PARTS LIST							
1		JF2P95	CN. 2 WAY MALE	P151,J152,J154 P155,J156			5
2		JF2S95	CN.2 WAY FEMALE	.151,P152,P154 J155,P156			5
3		JF2P2P95	CN. 4 WAY MALE	P150, P153			2
4		JF2S2S95	CN. 4 WAY FEMALE	J150, J153			2
5		311P409 -1P-A-12	D-CONNECTOR	J136,J148, J149			1
6		311P409 -1S-A-12	D-CONNECTOR	P136			1
7		311P409 -3P-A-12	D-CONNECTOR	J103			1
8		ST11965 -9-T28(S)	CONNECTOR	P147			1
9		ST11964 -9-T28(P)	CONNECTOR	J147			1
10		Q0516PT	PRT	PRT1-PRT9			9
11		L1760	THERMISTER	RT1,RT2,RT3			3
12		RER50F 97R6R	RESISTOR W.W	HR 13			1
13		206794-4	PINS				52
14		206793-1	SOCKETS				9
15		HK5234 R153L12B	HEATERS	RH1-RH6			6
16		HK5223 R347L12B	HEATERS	RH7-RH12			6
17		212447-1	JACKPOST FEMALE				6
18		22-661 -0501200	SHRINK SLEAVING				AR
19		AMS-3653 -30	TUBING				AR
20		MD920-26-X	WIRE				AR
21		24-304-0010319	TAPE				AR
22		NAS1352N02-8	FASTNER				6
23		NAS1352N02-6	FASTNER				4
24		NAS1387-1	SPLICE				2
25		0803X3	MIL-T-43485	LACING TAPE			AR
26							
27							
28							
29							
30							

SOLAR-A
SXT

Figure 4.1-2D (SXT-2M006) Temperature & Heater Locations - Sheet 4

HEATER AND TEMPERATURE SCHEMATIC

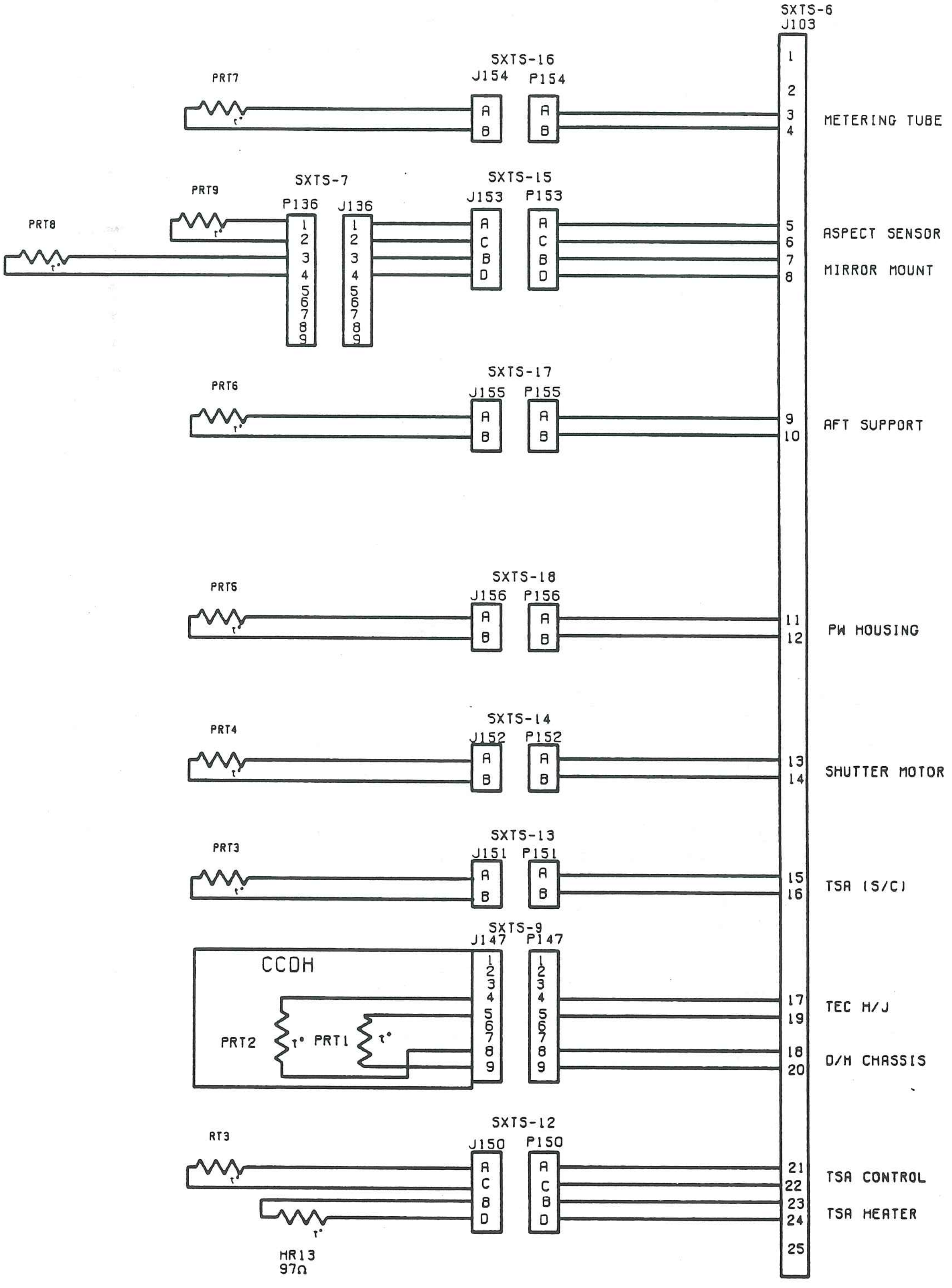


Figure 4.1-2E (SXT-2M006) Temperature & Heater Schematic - Sheet 5

Table 4.1-4
SXT Connector List

LPARL NO.	S/S NO.	PART NO.	WHERE USED/ LOCATION	HARNESS NO.
P101	SXTEU-1	311P10-4P-B-12 (DCM-37P-NMB-K52)	SXTE-J-SXTE-U PEB (I/F)	W-1
P102	SXTEU-2	311P10-3P-B-12 (DBM-25P-NMB-K52)	SXT-J-SXTE-U PEB (I/F)	W-1
P103	SXTS-6	311P10-3S-B-12 (DBM-25S-NMB-K52)	SXTE-J-SXTS TELESCOPE	W-2
P105	SXTEU-3	311P10-4S-B-12 (DCM-37S-NMB-K52)	JNC-SXTE-U PDU (I/F)	W-1
P108	SXTEU-4	311P10-2P-B-12 (DAM-15P-NMB-K52)	SXTE-U-FDE PEB	W-3
P109	SXTEU-5	311P10-3P-B-12 (DBM-25P-NMB-K52)	SXTE-U-SXTS PEB	W-5
P111	SXTEU-6	311P10-2P-B-12 (DAM-15P-NMB-K52)	SXTE-U-SXTS PDU	W-5
P112	SXTEU-7	311P10-1P-B-12 (DEM-9P-NMB-K52)	SXTE-U-CCDP PEB	W-4
P113	SXTEU-8	311P10-4S-B-12 (DCM-37S-NMB-K52)	SXTE-U-CCDP PEB	W-4
P116	SXTEU-9	311P10-3P-B-12 (DBM-25P-NMB-K52)	SXTE-U-SXTS PDU	W-3
P117	SXTEU-10	311P10-2P-B-12 (DAM-15P-NMB-K52)	SXTE-U-CCDP PDU	W-4
P122	CCDP-1	311P10-2S-B-12 (DAM-15S-NMB-K52)	CCDP-SXTE-U CCDP	W-4
P123	CCDP-2	311P10-4S-B-12 (DCM-37S-NMB-K52)	CCDP-SXTE-U CCDP	W-4
P125	CCDP-4	311P10-1S-B-12 (DEM-9S-NMB-K52)	CCDP-SXTE-U CCDP	W-4
P126	FDE-1	311P10-2S-B-12 (DAM-15S-NMB-K52)	FDE-SXTE-U FDEA	W-3
P127	FDE-2	311P10-2S-B-12 (DAM-15S-NMB-K52)	FDE-SXTE-U FDEB	W-3
P128	FDE-3	311P10-1P-B-12 (DEM-9P-NMB-K52)	FDE-SXTE-U FDE motor	W-6
P130	SXTS-4	311P10-1S-B-12	SXTS-SXTE-U	W-6

		(DEM-9S-NMB-K52)	FWA motor	
P131	SXTS-5	311P10-3S-B-12 (DBM-25S-NMB-K52)	SXTS-SXTE-U FWA encoders	W-5
P134	SXTEU-11	311P10-3P-B-12 (DBM-25P-NMB-K52)	SXTE-U-SXTS SMA driver	W-5
P135	SXTS-1	311P10-3S-B-12 (DBM-25S-NMB-K52)	SXTS-SXTE-U SMA motor	W-5
P142	SXTS-8	311P10-2S-B-12 (DAM-15S-NMB-K52)	SXTS-SXTE-U TELESCOPE	W-5
P148	SXTS-10	311P10-1S-B-12	SXTS-HCE FPG Heaters	N/A
P149	SXTS-11	311P10-1S-B-12	SXTS-HCE OBJ Heaters	N/A

Quantity to be provided to Japanese by US:

Part Number	PM	FLT
311P10-1S-B-12	0	4
311P10-1P-B-12	0	2
311P10-2S-B-12	0	4
311P10-2P-B-12	0	3
311P10-3S-B-12	0	3
311P10-3P-B-12	0	4
311P10-4S-B-12	0	3
311P10-4P-B-12	0	1

4.1.3.4 Connector Locations -

See Figures 2.4-4, 2.4-5, 2.4-6, and 2.4-7 for the connector locations. Connector names shall be printed on the boxes next to the connectors, as specified in Solar-A 102. Connector names will also be printed on the cable connectors.

4.1.3.5 Cable Mounting Provisions -

See Figures 2.4-4, 2.4-5, 2.4-6, and 2.4-7 for cable mounting provisions. NEC will attach harness supports with epoxy as required. Low outgassing properties are required for the epoxy and the harness ties.

4.1.3.6 RD,MD,SD,TN - Connectors -

Kind	Item	Description
MD	CCD stimulus-HOT CCD stimulus-RTN	power cable to SXTS for illuminating CCD for test purpose. Max current = 15 mA. (Fig. 4.3.-1, and Fig. 5.1-2)
RD	NOT REQUESTED	
SD	NOT REQUESTED	
TN	NOT REQUESTED	

SXTS MD interface circuit is described in figure 5.1-2 SXTE-J/SXTE-U interface,power.

4.2 Electronic Design Standards -

```
                                1   _________
Power control command timing    0 __| 31.2 ms |__
```

The logic between the Japanese and US interface shall be "POSITIVE TRUE". With the exception of the digital interface (see Sect 4.2.1 below) the SXT electronic design shall be in accordance with the following sections of SOLAR-A 101 (Electric Design Standards):

2.2	Grounding procedure
2.3	Voltage drop between a subsystem and CNV
2.5	Failure separation
2.6	Measures for EMI
2.7	Unswitched power source

4.2.1 Digital Signal Description -

All logic signals crossing the SXTE-J/SXTE-U interface are active high (positive logic). The electrical characteristics of all interface logic signals are as follows:

Voltage characteristics:		
Output low	maximum	0.4 volts
Output high	minimum	4.6 volts
Input low	maximum	1.0 volts
Input high	minimum	4.0 volts
Current characteristics:		
Output low	minimum	2.4 mA
Output high	minimum	0.6 mA
Input	maximum	+/-0.001 mA

NOTE:
These specifications are derived from the data sheets for device types 4049BU/4050B.

4.2.1.1 Reset Strobe: -

```
Reset,     5V      ______________
Hard/Soft         |              |
(J-->U)    0V_____|              |_______

                  |<--4 mS min-->|
```

4.2.1.2 Power Control: -

```
                        |<------ 200 msec min ------>|
Command    5V            _____________                _____________
Act                     |             |              |             |
(J-->U)    0V___________|             |______,,______|             |____

                        |<--31.2 mS-->|
                        |             |
           15 uS |<---->|             |<---->| 15 uS
             min |                    |      |   min
                 |                    |      |
Command    5V___  __________________________  ___
Bus             \/                          \/
(J-->U)    0V___/\__________________________/\___
```

4.2.1.3 Command Bus And Signals: -

```
                  15 uS |<---->|<------ 1.0 mS min  ------>|
                    min |      |                           |
Command    5v            ______                             ______
Strobe                  |      |                           |      |
(J-->U)    0V___________|      |____________,,_____________|      |____

           15 uS |<---->|      |<---->| 15 uS
             min |                    |   min
                 |                    |
Address    5V___  ___________________  ___
Bus             \/                   \/
(J-->U)    0V___/\___________________/\___
                 |                    |
                 |                    |
Command    5V___  ___________________  ___
Bus             \/                   \/
(J-->U)    0V___/\___________________/\___
```

4.2.1.4 Status Bus And Signals: -

Relationship between Command, Status Request, and Status Ready strobe pulses can be either 1 or 2 msec based on the following:

Case #	Condition	DELTA
1	Command---->Command	1 msec
2	Command---->Status Req	1 msec
3	Status Req----->Command	2 msec
4	Status Req----->Status Req	2 msec
5	Status Rdy----->Command	Not Specified

```
                          |<---------------- DELTA  -------------->|
                    15 uS |<--->|                            15 uS |<--->|
                      min |     |                              min |     |
  Status       5v          _____                                    _____
  Request                 |     |                                  |     |
  (J-->U)      0V_________|     |_______________,,_________________|     |_

               15 uS |<---->|      |<---->| 15 uS
                 min |             |   min
                     |             |
  Address      5V___  _____________________  ___
  Bus               \/                     \/
  (J-->U)      0V___/\_____________________/\___
                               |
                               |
                               |<------500 uS ----->|<---->| 15 uS
  Status                                             ______    min
  Ready                                             |      |
  (U-->J)_________________________________________ |      |______________

                                       15 uS |<---->|      |<---->| 15 uS
                                         min |                    |   min
  Status       5V____________________________  ____________________  ___
  Bus                                        \/                    \/
  (U-->J)      0V____________________________/\____________________/\___
```

4.2.1.5 Image Data Gate And Syncs: -

Timing relationships at the SXTE-J/SXTE-U interface. A timing skew of 0.5 uS introduced by the SXTE-U electronics system is included.

```
  Frame   5V   ______________________________,,____________________________
  Gate        |                                                            |
  (U-->J) 0V__|                                                            |__

  Line    5V  |       _____________________,,______________________        |
  Sync3       |      |                                             |       |
  (U-->J) 0V_________|       (envelopes line of "good" data)       |______ |
                                                                           |
  Word    5V  |      |      __    __         __    __    __        |       |
  Sync        |      |     |  |  |  |       |  |  |  |  |  |       |       |
  (U-->J) 0V_______________|  |__|  |___,,__|  |__|  |__|  |______ |       |
                              ^                                    |       |
                              First active edge

                Tfls                                           Twle
              |<---->|                                     |<---->|
                     |<--->|                                       |<----->|
                       Tlws                                           Tlfe
```

FG = Frame gate
LS3 = Line Sync 3
WS = Word Sync

Symbol	Parameter	Min.		Typ.		Max.	
Tfls	FG to LS3 start interval	8.1	mS	8.1	mS	8	Sec
Tlws	LS3 to WS start interval	6.91	uS	7.656	uS	7.91	uS
Twle	WS to LS3 end interval	3.4	uS	3.9	uS	4.4	uS
Tlfe	LS3 to FG end interval	7.1	uS	7.6	uS	8.1	uS

NOTES:

1) Word syncs are generated without LS3 for the CCD status data ("first line").
2) There is no WS during Full Frame Flush.
3) Tfls is variable.. The numbers shown 8.1 mS is for no lines summed.
   Summing adds 15.2 usec per line.
   It will also increase by 15.2 uS times the number of lines with fast line transfers plus 8.1 mS times the number of lines in the guard band(flush), prior to the ROI.
4) FG delineates the total frame readout period, including the "first line".
5) First active edge is the word sync edge on which JPL recommends to read the first word of camera data.

4.2.1.6 Image Data Bus And Sync Signals: -

Timing relationships at the SXTE-J/SXTE-U interface. A timing skew of 0.5 uS introduced by the SXTE-U electronics system is included.

```
                  |<------ 7.656 uS nominal (n=1) ------->|
                  |        15.312 uS nominal (n=2)        |
                  |        30.624 uS nominal (n=4)        |
Word       5V      _____________________                   ______________
Sync              |                     |                 |
(U-->J)    0V____|<-- 3.828 uS nom -->|_________________|

                  |                                       |
                  |<-->| 1.0 uS max               |<-->| 1.0 uS max
                  |    |                          |    |
Image      5V________  ___________________________  ____________________
Data Bus            \/         valid data          \/
(U-->J)    0V_______/\_____________________________/\____________________
```

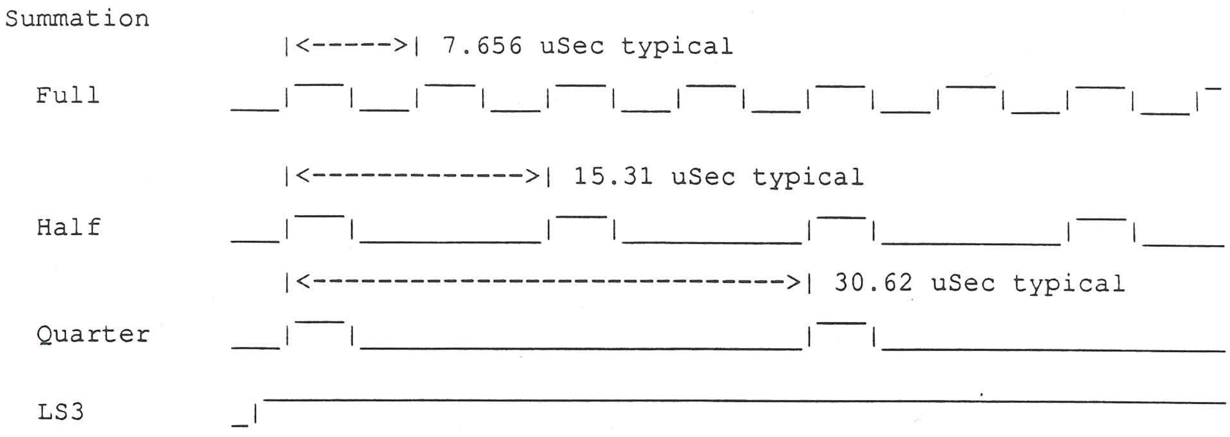
NOTE:
1. This specification assumes a pixel data rate of 131,072 pixels per second.
2. Pixel data seen at the SXTE-J interface is one Word Sync cycle behind data coming from the camera. This scheme eliminates timing problems due to skew across the two interfaces. The total number of Word Sync pulses seen by SXTE-J is the same as the total number generated by the CCD camera, but the pixel data seen by SXTE-J for a given Word Sync pulse is actually generated by the CCD camera on the previous Word Sync pulse.

4.2.1.7 Image Data Across CCDE/P - SXTE-U Interface -

Summation modes of n=1, 2, and 4 have the following number of Word Sync pulses:

# of WS		Summation Mode	
	Full	Half	Quarter
# of Row #s	1	1	1
# of BLS	25	25	25
# of image data	1024	512	256
Total	1050*	538	282

* For a full resolution ROI, the first line over the interface will generate 1052 word syncs when immediately preceded by a fast line parallel transfer. In practice, this condition will occur when the following conditions are met:
1. ROI start row is not zero,
2. Width of guard band is 0 (zero),
3. ROI start row is not immediately preceded by an ROI (for #ROIs>1).



4.2.1.8 Image Data Across SXTE-U - SXTE-J Interface -

X = Invalid
L# = Line number
B_ = BLS number "_"
I_ = Image data number "_"

```
Full Summation Mode
                 WS# 1    2  3  4  ... 27  28  29  ..... 1024 ... 1050
                     X    L# B1 B2 ... B25 I0  I1  ..... I996 ... I1022
    Cal Mode         ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Obs Mode                           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Out of CCDP          ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

Half Summation Mode
                 WS# 1    2  3  4  ... 27  28  29  ..... 512  ... 538
                     X    L# B1 B2 ... B25 I0  I1  ..... I484 ... I510
    Cal Mode         ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Obs Mode                           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Out of CCDP          ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^

Quarter Summation Mode
                 WS# 1    2  3  4  ... 27  28  29  ..... 256  ... 282
                     X    L# B1 B2 ... B25 I0  I1  ..... I228 ... I254
    Cal Mode         ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Obs Mode                           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
    Out of CCDP          ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
```

4.3 SXT Interface Inter-connect Diagram -

The SXT Interface Inter-connect diagram is shown in Figure 4.3-1 [SXT-2E025].

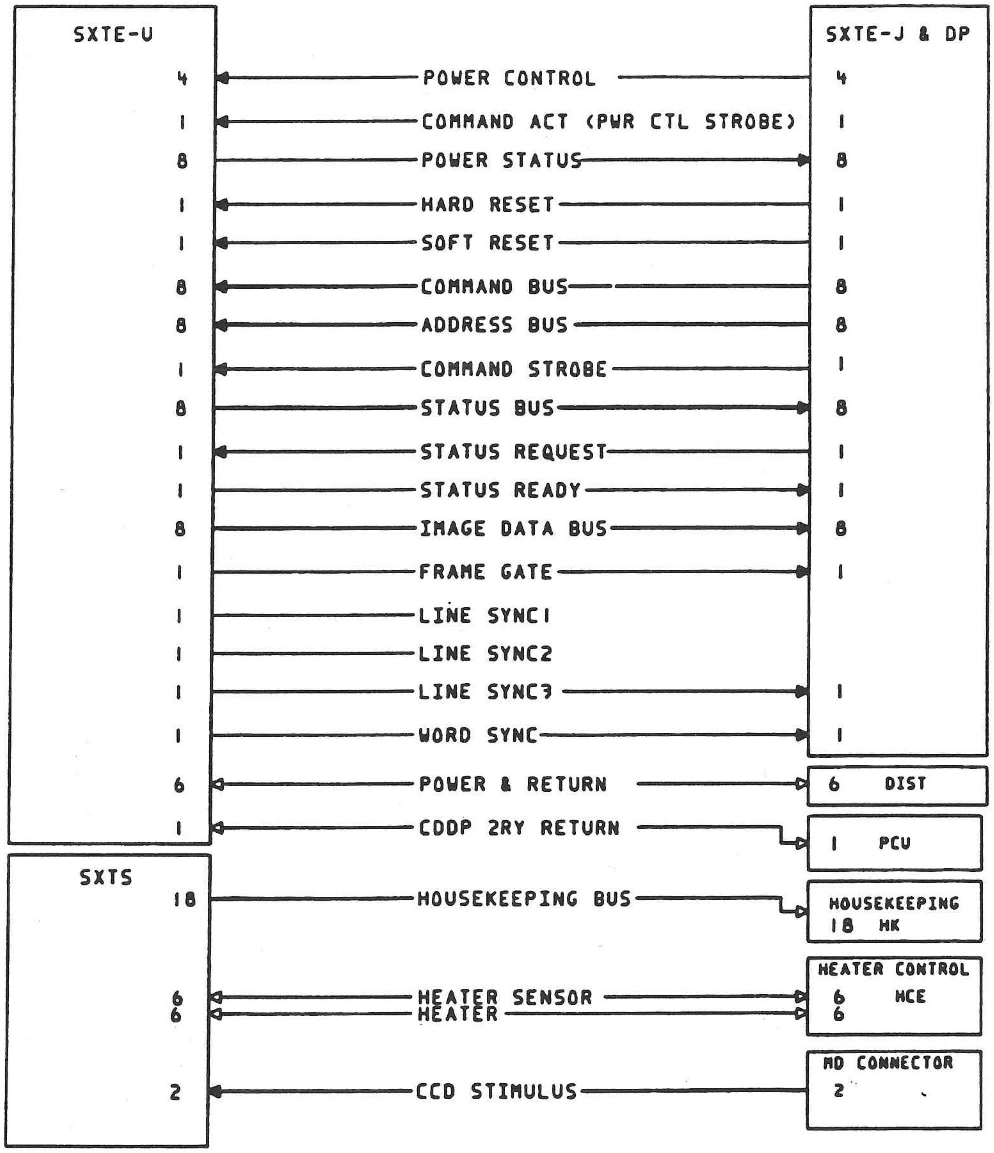


Figure 4.3-1 [SXT 2E025] SXT Interface
Interconnect Diagram FM

4.4 Power Control Block Diagram -

The SXT Power Control Block Diagram is shown in Figure 4.4-1 [SXT-2E024].

Table 4.4-1
SXTE-U Status Signal Description

Status	Relay & Contact(s) Monitored	Voltage	Relay Function
A	Main Power (K1-A) Secondary Power (K3-A)	5	1. To uP system 2. To shutter pwr relay K6-A 3. To uP system select relay K7
B	Main Power (K2 & K2-A) Secondary Power (K4 & K4-A)	28	1. To CCDP pwr relay 2. To filter pwr relay K5 & K5-A 3. To shutter pwr relay K6
C	Filter Power (K5 & K5-A)	28	1. To system select relay K7
D	Shutter/Aspect Controller Power (K-6A)	5	1. To system select relay K8-A 2. To aspect cover controller
E	Microprocessor Select (K7)	5	1. To microprocessor A
F	Microprocessor Select (K7)	5	1. To Microprocessor B
G	CCD Camera Power	5	1. To CCD electronics
H	TEC Power	5	1. To TEC

NOTE:

1. 0V indicates no voltage present at the point being monitored.
2. 4.3V-5V indicates voltage present at the point being monitored.

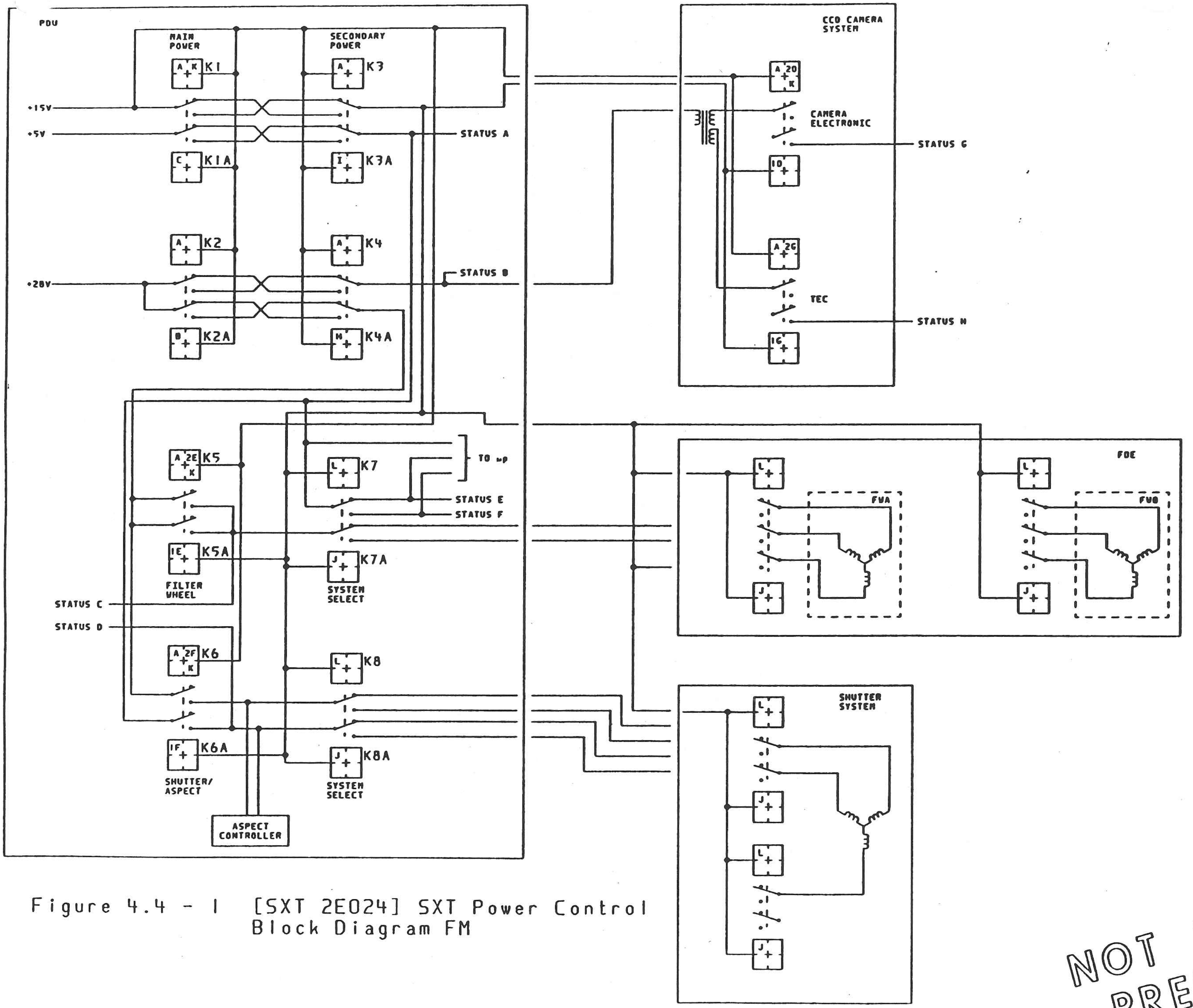


Figure 4.4 - 1 [SXT 2E024] SXT Power Control Block Diagram FM

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JPL Camera Grounding using Secondary Return

MDM 15-Sept-88

- Secondary return used
  (secondary return NOT tied to SXTE-U logic ground)
- CCDE/P Isolated from spacecraft
- CCDH Isolated from SXTS

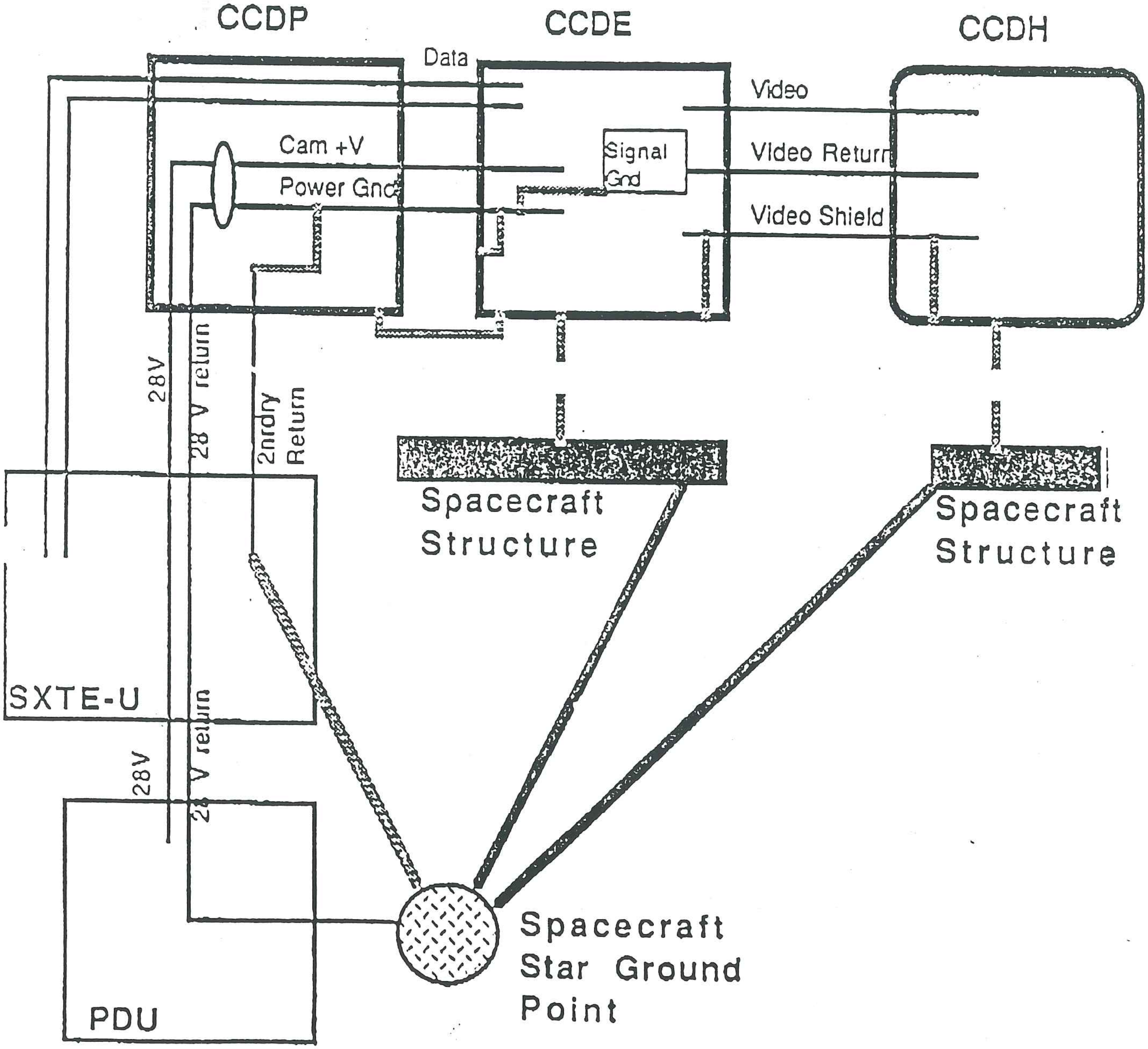

FIGURE 4.4-2 Grounding Scheme 1 for Camera

Figure 4.4-3 Deleted

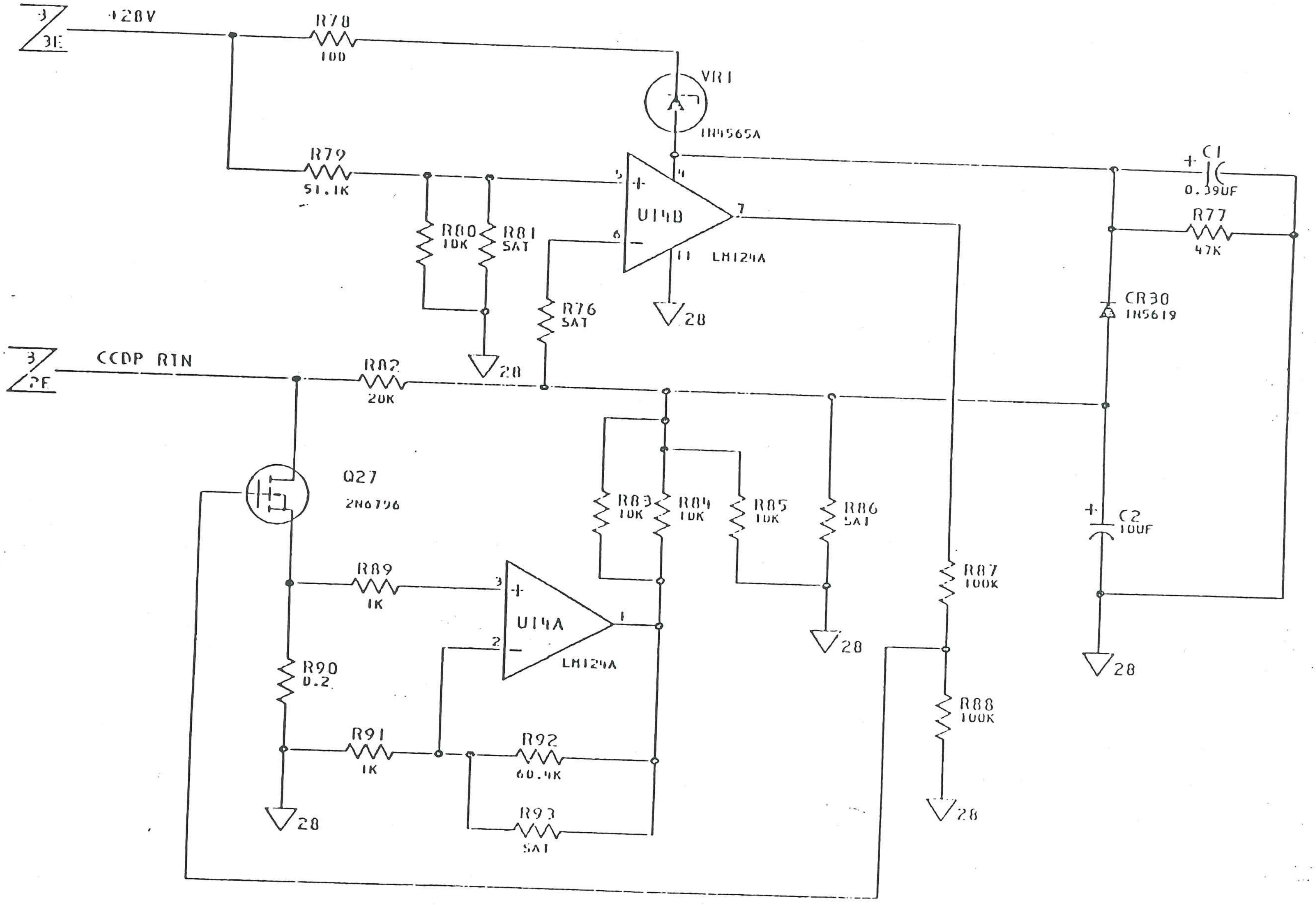

FIGURE 4.4-4 Camera Current limiter circuit

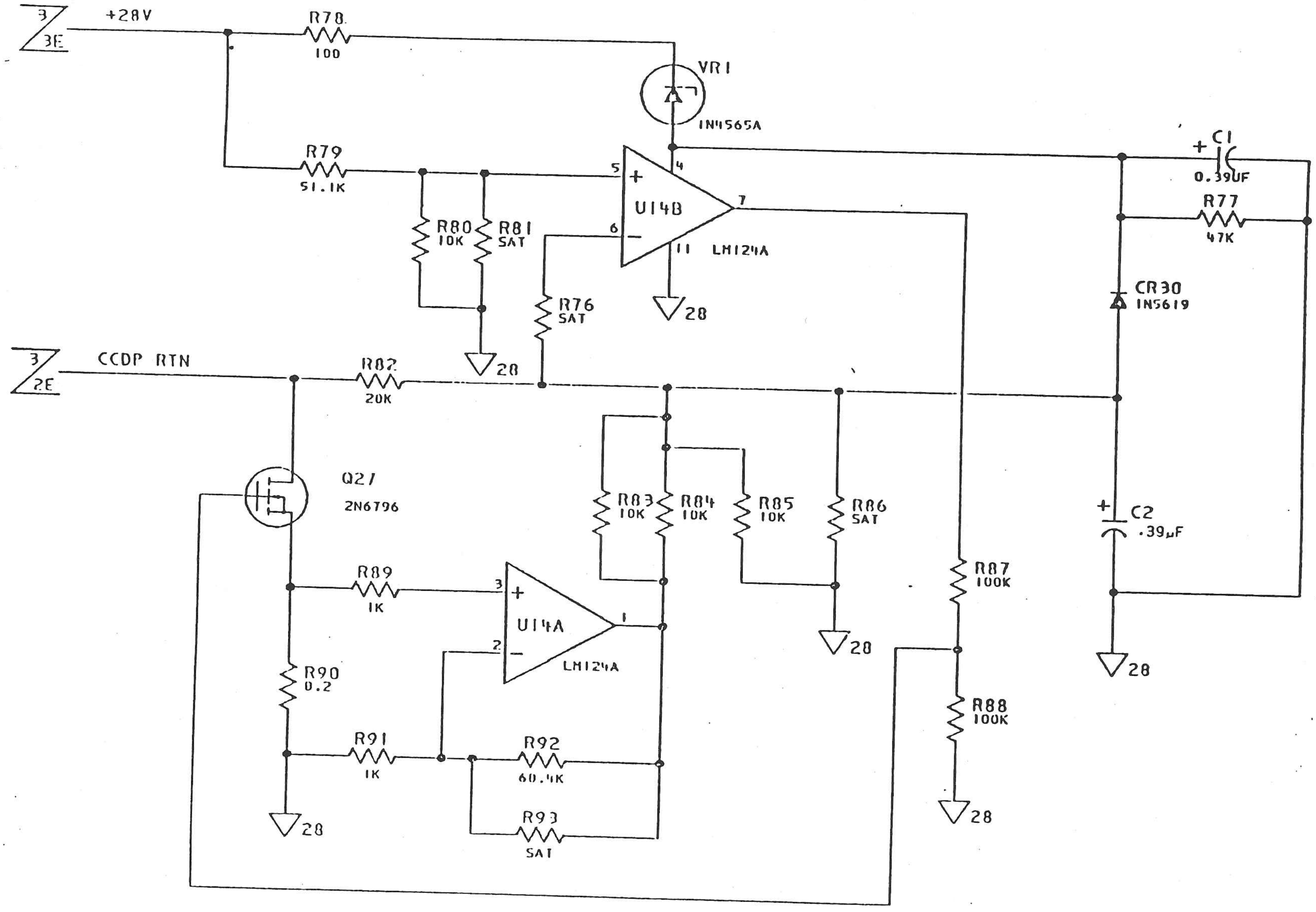

Figure 4.4-5 Shutter/Aspect Current limiter circuit

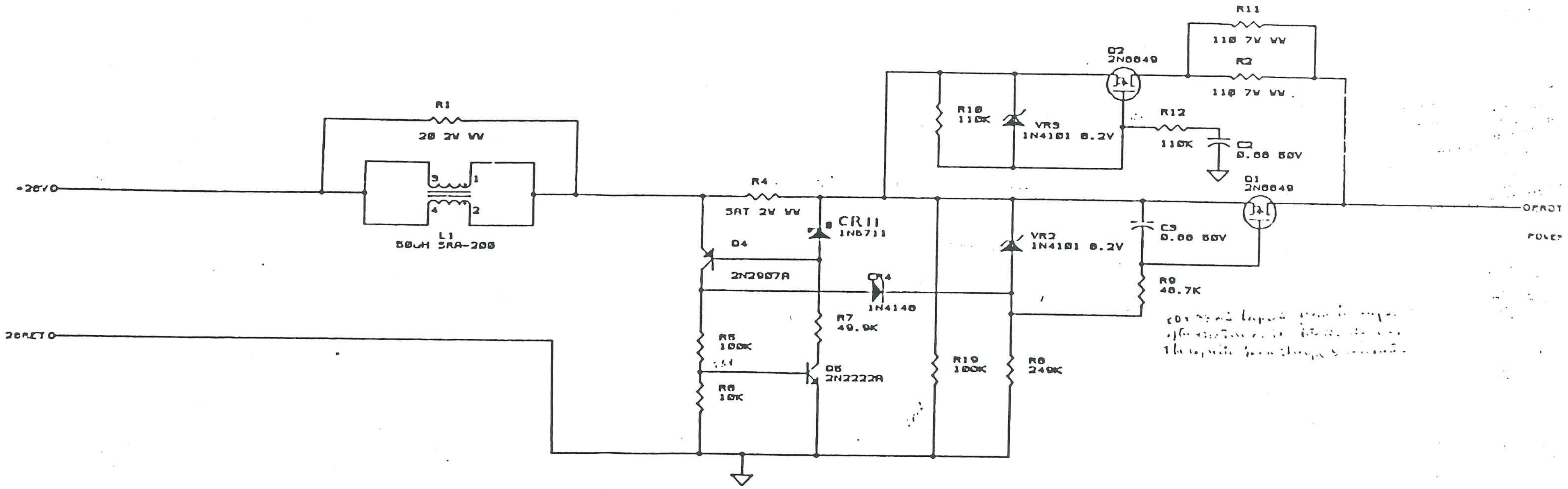

Figure 4.4-6   FDE Current limiter circuit

4.5 Interface Connector Pin Assignments -

Interface connector pin assignments are contained in Tables 4.5-1, 4.5-2, 4.5-3, 4.5-4, 4.5-5, and 4.5-6.

Table 4.5-1
Cmd/Status I/O

PROJECT: SOLAR-A
SYSTEM: SXTE-U (PEB)
HARNESS CONNECTOR: SXTEU-1 (311P10-4P-B-12)(DCM-37P-NMB-K52)
(P101)
S/S CONNECTOR: SXTEU-1 (311P409-4S-B-12)(CMD/STATUS I/O)
(J101)

DATE: 29 Mar 90
PAGE: 1
SXT2E001.REV

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	Status Request Input (STA_REQ)	26	NS	DPSX17-11	
20	Chassis ground				
2	Command Strobe Input (CMD_STR)	26	NS	DPSX17-37	
21	Chassis ground				
3	Address 0 Input (LSB)	26	NS	DPSX17-14	
22	| 1 |	|	|	| -32	
4	| 2 |	|	|	| -13	
23	| 3 |	|	|	| -12	
5	| 4 |	|	|	| -31	
24	| 5 |	|	|	| -30	
6	| 6 |	|	|	| -29	
25	Address 7 Input (MSB)	26	NS	DPSX17-28	
7	Chassis ground				
8	Command 0 Input (LSB)	26	NS	DPSX17-36	
26	| 1 |	|	|	| -35	
9	| 2 |	|	|	| -18	
27	| 3 |	|	|	| -34	
10	| 4 |	|	|	| -17	
28	| 5 |	|	|	| -16	
11	| 6 |	|	|	| -33	
29	Command 7 Input (MSB)	26	|	DPSX17-15	
30	Chassis ground				
12	Status Ready (STA_RDY)	26	NS	DPSX17-10	
31	Status 0 Output (LSB)	26	NS	| -9	
13	| 1 |	|	|	| -8	
32	| 2 |	|	|	| -7	
14	| 3 |	|	|	| -6	
33	| 4 |	|	|	| -5	
15	| 5 |	|	|	| -4	
34	| 6 |	|	|	| -3	
16	Status 7 Output (MSB)	26	NS	DPSX17-2	
35	Chassis ground				
17	Hard Reset Input (HD-RST)	26	S	DPSX16-16	
36*	Shield				
18	Soft Reset Input (ST_RST)	26	S	DPSX16-17	
37*	Shield				
19					

* Shields tied to this end only (receiver end).

Table 4.5-2
Data I/O

PROJECT: SOLAR-A
SYSTEM: SXTE-U (PEB)
HARNESS CONNECTOR: SXTEU-2 (311P10-3P-B-12)(DBM-25P-NMB-K52)
(P102)
S/S CONNECTOR: SXTEU-2 (311P409-3S-B-12) (DATA I/O)
(J102)

DATE: 29 Mar 90
PAGE: 2
SXT2E001.REV

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	Line Sync3 (LS3) (ROI ENVELOPE)	26	S	DPSX15-14	
14	Chassis ground			DPSX15-7 *	
2	Word Sync (WS)	26	S	DPSX16-18	
15	Chassis ground			DPSX16-6 *	
3	Frame Gate Output (FG)	26	S	DPSX15-15	
16	Chassis ground			| -8 *	
4	Image Data 0 Output (LSB)	26	S	| -2	
5	| 1 |	|	|	| -3	
6	| 2 |	|	|	| -4	
7	| 3 |	|	|	| -5	
17	| 4 |	|	|	| -9	
18	| 5 |	|	|	| -10	
19	| 6 |	|	|	| -11	
20	Image Data 7 Output (MSB)	26	S	| -12	
21	Chassis ground			DPSX15-1 *	
8	NC				
9	NC				
10	NC				
11	NC				
12	NC				
13	NC				
22	NC				
23	NC				
24	Line Sync1 (LS1) (test only)				
25	Line Sync2 (LS2) (test only)				

*Shield tied to this end only (receiver end).

Table 4.5-3
Housekeeping I/O

PROJECT: SOLAR-A
SYSTEM: SXTS (TELESCOPE)
HARNESS CONNECTOR: SXTS-6 (311P10-3S-B-12) (DBM-25S-NMB-K52)
(P103)

DATE: 29 Mar 90
PAGE: 3
SXT2E001.REV

S/S CONNECTOR: SXTS-6 (311P409-3P-B-12)(H/K INTERFACE)
(J103)

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	NC				
2	NC				
3	sensor 7 Metering Tube Temp	26	TP1a	HK9-7	
4	| 7 Metering Tube Temp	|	|1b	| -8	
5	| 9 Aspect Telescope Cell Temp	|	|2a	| -9	
6	| 9 Aspect Telescope Cell Temp	|	|2b	| -10	
7	| 8 Mirror Assembly Mount Temp	|	|3a	| -11	
8	| 8 Mirror Assembly Mount Temp	|	|3b	| -12	
9	| 6 Aft Support Plate Temp	|	|4a	| -13	
10	| 6 Aft Support Plate Temp	|	|4b	| -14	
11	| 5 FW Housing Temp	|	|5a	| -15	
12	| 5 FW Housing Temp	|	|5b	| -16	
13	| 4 Shutter Mtr Case Temp	|	|6a	| -17	
14	| 4 Shutter Mtr Case Temp	|	|6b	| -18	
15	| 3 TEC Thermal Shunt Temp	|	|7a	| -20	
16	| 3 TEC Thermal Shunt Temp	|	|7b	| -21	
17	| 2 TEC H/J Temp	|	|8a	| -22	
18	| 2 TEC H/J Temp	|	|8b	| -23	
19	| 1 D/H Chassis Temp	|	|9a	| -24	
20	| 1 D/H Chassis Temp	|	|9b	HK9-25	
21	| 10 Heater Control	|	|10a	HCE1-29	
22	| 10 Heater Control	|	|10b	HCE1-11	
23	Lead 1 to Heater	|	|11a	HCE2-26	
24	Lead 2 to Heater	26	TP11b	HCE2-27	
25	NC				

Table 4.5-4
Power and Command Input

PROJECT: SOLAR-A
DATE: 29 Mar 90
SYSTEM: SXTE-U (PDU)
PAGE: 4
HARNESS CONNECTOR: SXTEU-3 (311P10-4S-B-12)(DCM-37S-NMB-K52)
(P105)
SXT2E001.REV
S/S CONNECTOR: SXTEU-3 (311P409-4P-B-12) (PWR & CMD INPUT)
(J105)

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	5V Input	20	TP1a	DIST6-13	
2	5V Return	20	TP1b	DIST8-22	
3	15V Input	22	TP2a	DIST12-10	
4	15V Return	|	TP2b	DIST12-28	
5	28V Input	|	TP3a	DIST10-18	
6	28V Return	|	TP3b	DIST10-36	
7	CCDP Secondary Return	22	NS	(?)	
8	NC				
20	Chassis ground				
9	Command Input Bit 0 (LSB)	26	NS	DPSX16-25	
10	| 1	|	|	| -24	
11	| 2	|	|	| -23	
12	Command Input Bit 3 (MSB)	|	|	| -22	
13	Command Act	26	NS	DPSX16-21	
14	Chassis ground				
15	NC				
16	NC				
17	NC				
18	Status G CCD Camera Relay Monitor	26	NS	DPSX16-9	
19	Status H CCD TEC Relay Monitor	|	|	| -8	
21	Status A	|	|	| -15	
22	Status B	|	|	| -14	
23	Status C	|	|	| -13	
24	Status D	|	|	| -12	
25	Status E	|	|	| -11	
26	Status F	26	NS	DPSX16-10	
27	NC				
28	Chassis ground				
29	CCD Stimulus	26	NS	MD1-1	
30	CCD Stimulus	26	NS	MD1-2	
31	Chassis ground				
32	NC				
33	NC				
34	NC				
35	NC				
36	NC				
37	NC				

Table 4.5-5
Focal Plane Group Heater

PROJECT: SOLAR-A DATE: 29 Mar 90
SYSTEM: SXTS (FILTER WHEEL ASSEMBLY) PAGE: 41
HARNESS CONNECTOR: SXTS-10 (311P10-1S-B-12) (DEM-9S-NMB-K52)
(P148) SXT2E001.REV
S/S CONNECTOR: SXTS-10 (311P409-1P-B-12) (FPG HEATER)
(J148)

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	FPG Heater Sensor	26	TP1a	HCE1-9	
2	FPG Heater Sensor RTN	|	TP1b	HCE1-27	
3	FPG Heater (+)	|	TP2a	HCE2-24	
4	FPG Heater (-)	26	TP2b	HCE2-32	
5	*Blank*				
6	*Blank*				
7	*Blank*				
8	*Blank*				
9	*Blank*				

Table 4.5-6
Objective Group Heater

PROJECT: SOLAR-A DATE: 29 Mar 90
SYSTEM: SXTS (OBJECTIVE GROUP) PAGE: 42
HARNESS CONNECTOR: SXTS-11 (311P10-1S-B-12) (DEM-9S-NMB-K52)
(P149) SXT2E001.REV
S/S CONNECTOR: SXTS-11 (311P409-1P-B-12) (OBJECTIVE GROUP HEATER)
(J149)

CONTACT	DESCRIPTION	WIRE GAUGE	WIRE TYPE	OTHER END	PAGE
1	OBG Heater Sensor	26	TP1a	HCE1-8	
2	OBG Heater Sensor RTN	|	TP1b	HCE1-26	
3	OBG Heater (+)	|	TP2a	HCE2-5	
4	OBG Heater (-)	26	TP2b	HCE2-13	
5	*Blank*				
6	*Blank*				
7	*Blank*				
8	*Blank*				
9	*Blank*				

4.6 SXT System Block Diagram -

The SXT System Block diagrams are shown in Figure 4.6-1, 4.6-2.

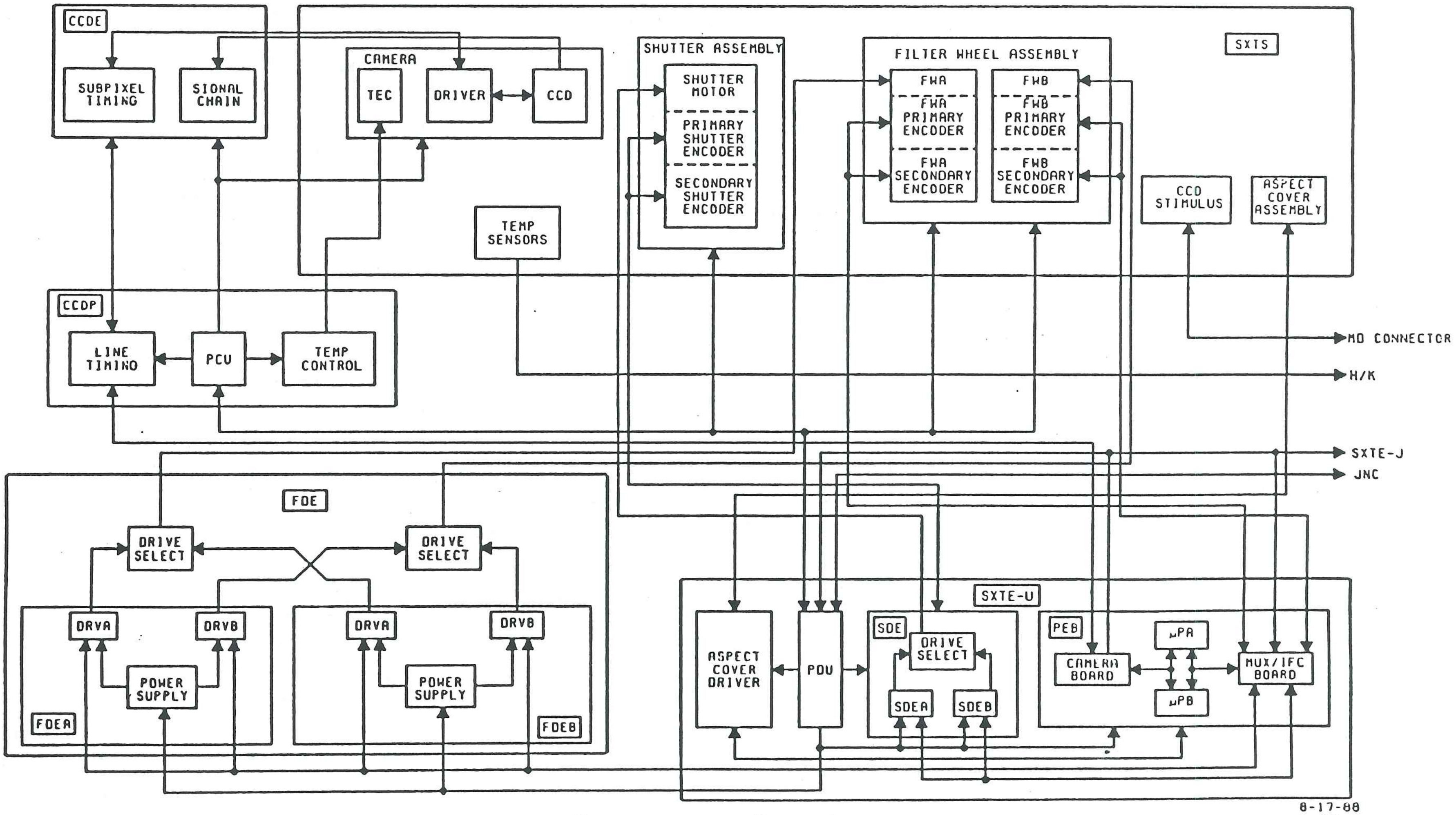

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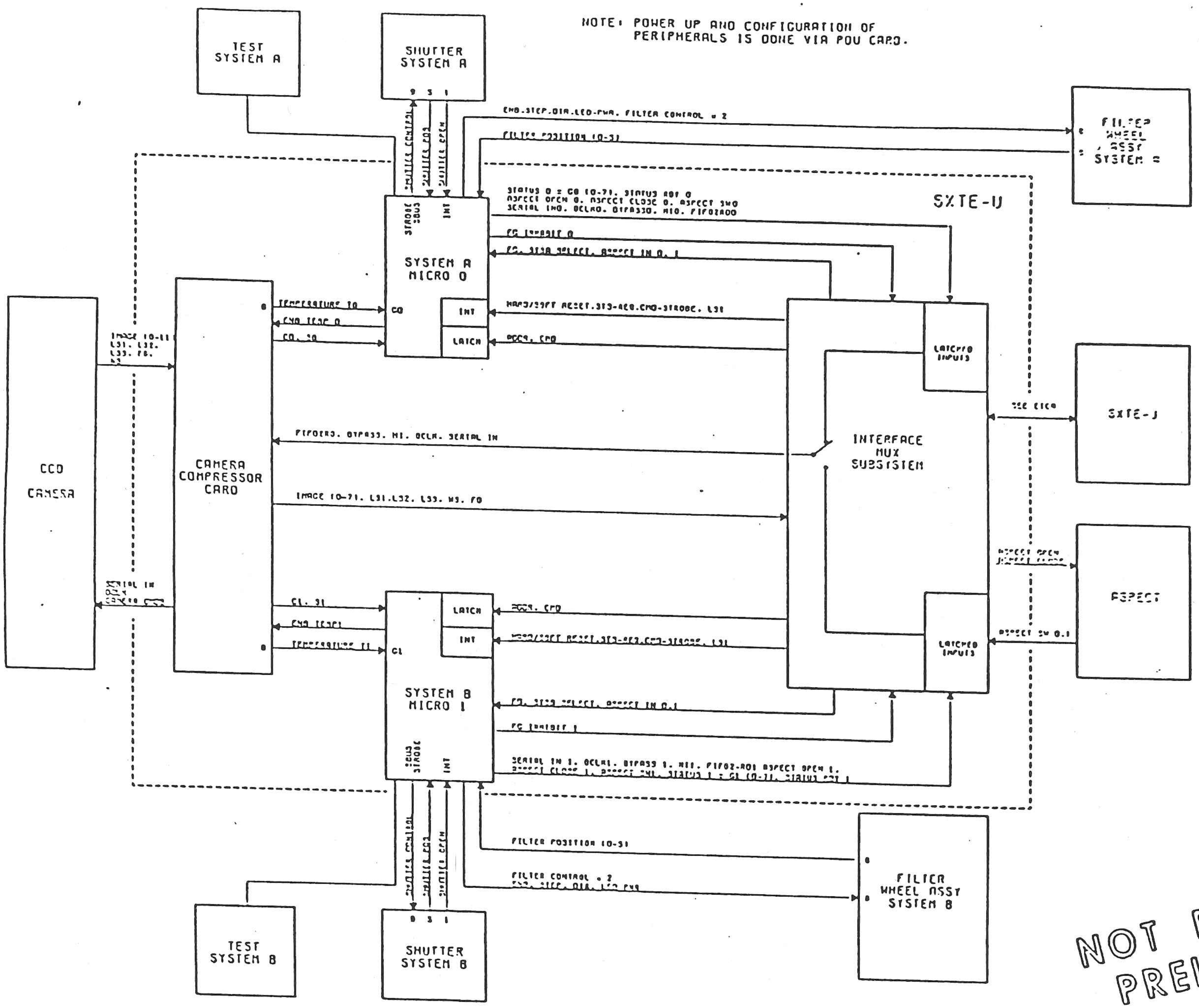
Figure 4.6 - 1 [SXT 2E022] SXT System Block Diagram FM



NOTE: POWER UP AND CONFIGURATION OF PERIPHERALS IS DONE VIA PDU CARD.

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FIGURE 4.6-2 SXT COMPUTER SYSTEM BLOCK DIAGRAM

4.7 Bonding -

The SXT instrument and electronics boxes shall be installed in the spacecraft so as to achieve a direct current impedance of less than 2.5 milliohms from component to structure.

4.8 EMC/EMI -

The EMI/EMC requirements for the SXT experiment will be in accordance with MSFC-SPEC-521A. The completed Flight Model SXT will be tested against this standard and results of the test will be reported to ISAS/NAOJ/IAUT.

4.9 Current Limiters -

Current limiters Characteristics

S/S	Location	Operating threshold	Time constant	Type
CCDP	SXTE-U	~ 1 A	50 ms	non-latch
CCDE/P(ADC)	CCDE	~ 50mA	< 1 ms	latch until camera readout
Shutter	SXTE-U	~ .95 A	1.8 ms	non-latch
Aspect	SXTE-U	~ .95 A	1.8 ms	non-latch
FDE	FDE	~ 1 A	24 ms	latch

Note: latch-power must be removed to restore circuitry.
Non -latch-power is restored when overcurrent is removed.
For current limiter drawings see Figures 4.4-4,5,6.

4.10 SXT CCD To Spacecraft Grounding Interface. -

Figure 4.4-2 is the Flight Model grounding configuration.

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CHAPTER 5

COMMAND AND DATA HANDLING

5.1 Command Interfaces -

The power command hardware interface on the U.S. side is shown in Figure 5.1-1 and 5.1-2. The status and command hardware interface on the U.S. side is shown in Figure 5.1-3 [SXT-2E039].

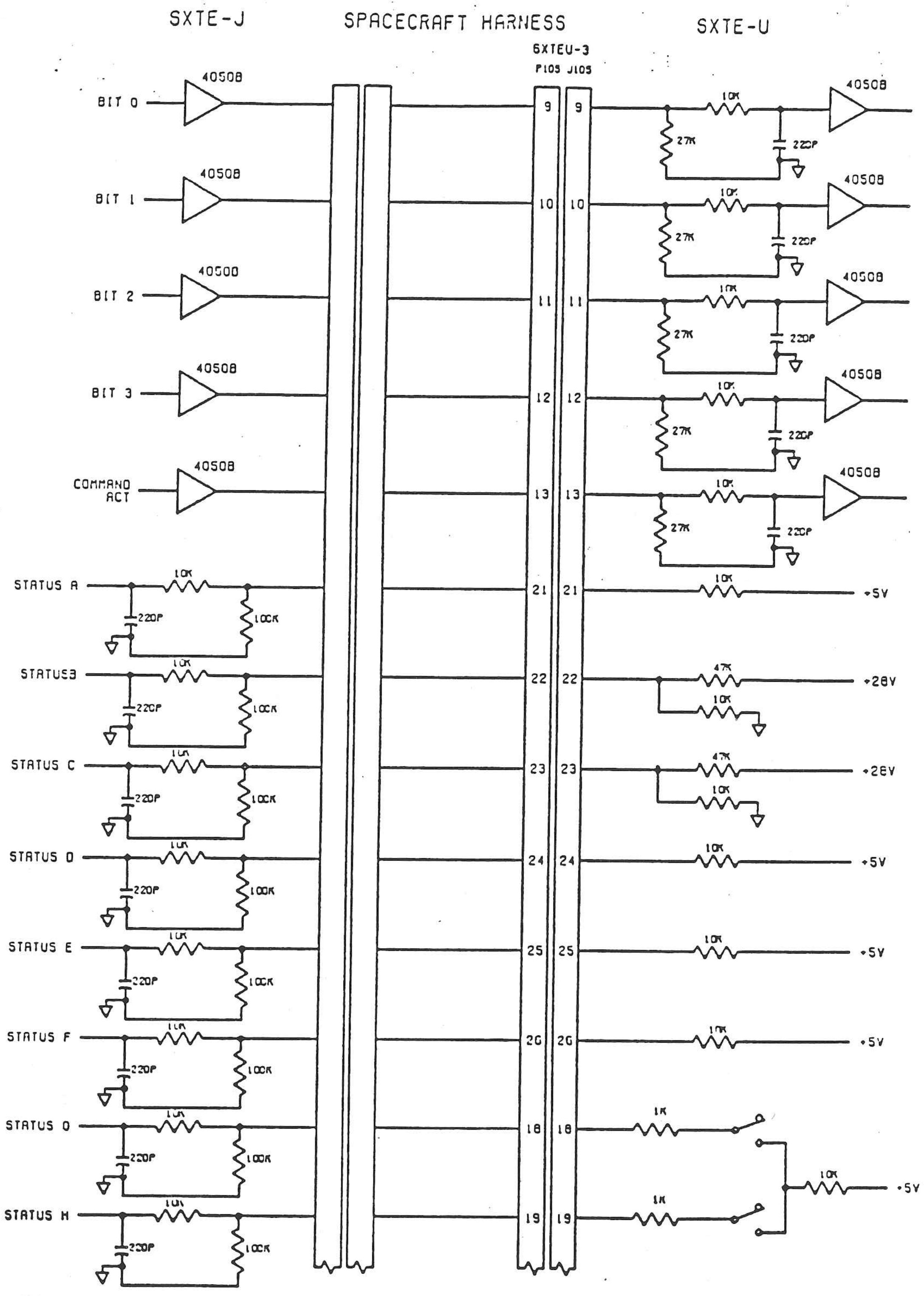
5.1.1 Hardwire Commands -

Commands to turn power on or off to various systems are transmitted directly by the codes shown in Table 5.1-1.

Table 5.1-1
Hardwire Commands

Item		Bit		Hex A	Function
A	OFF	1000	0000	80	All power OFF
B	ON	1000	0001	81	Main +28V Power
C	ON	1000	0010	82	Main +15V Relay & +5V Logic Power
1D	ON	1000	0011	83	CCD Camera
1E	ON	1000	0100	84	Filter FDE
1F	ON	1000	0101	85	Shutter System/Aspect
1G	ON	1000	0110	86	TEC
L	ON	1000	0111	87	Select A Mode
J	ON	1000	1000	88	Select B Mode
2G	OFF	1000	1001	89	TEC
2F	OFF	1000	1010	8A	Shutter System/Aspect
2E	OFF	1000	1011	8B	Filter FDE
2D	OFF	1000	1100	8C	CCD Camera
I	*	1000	1101	8D	Back-up to +15V Relay & +5V Logic Power
H	*	1000	1110	8E	Back-up to +28V Power
K	ON	1000	1111	8F	"A" above, but excluding TEC

* Energized only in event of failure to primary relays. Failure mode of primary determines position.



NOTE:
1. CONNECTOR PIN ASSIGNMENTS FOR REFERENCE ONLY.
2. ALL LEADS BETWEEN SXTE-J AND SXTE-U ARE 26 GAUGE UNSHIELDED.

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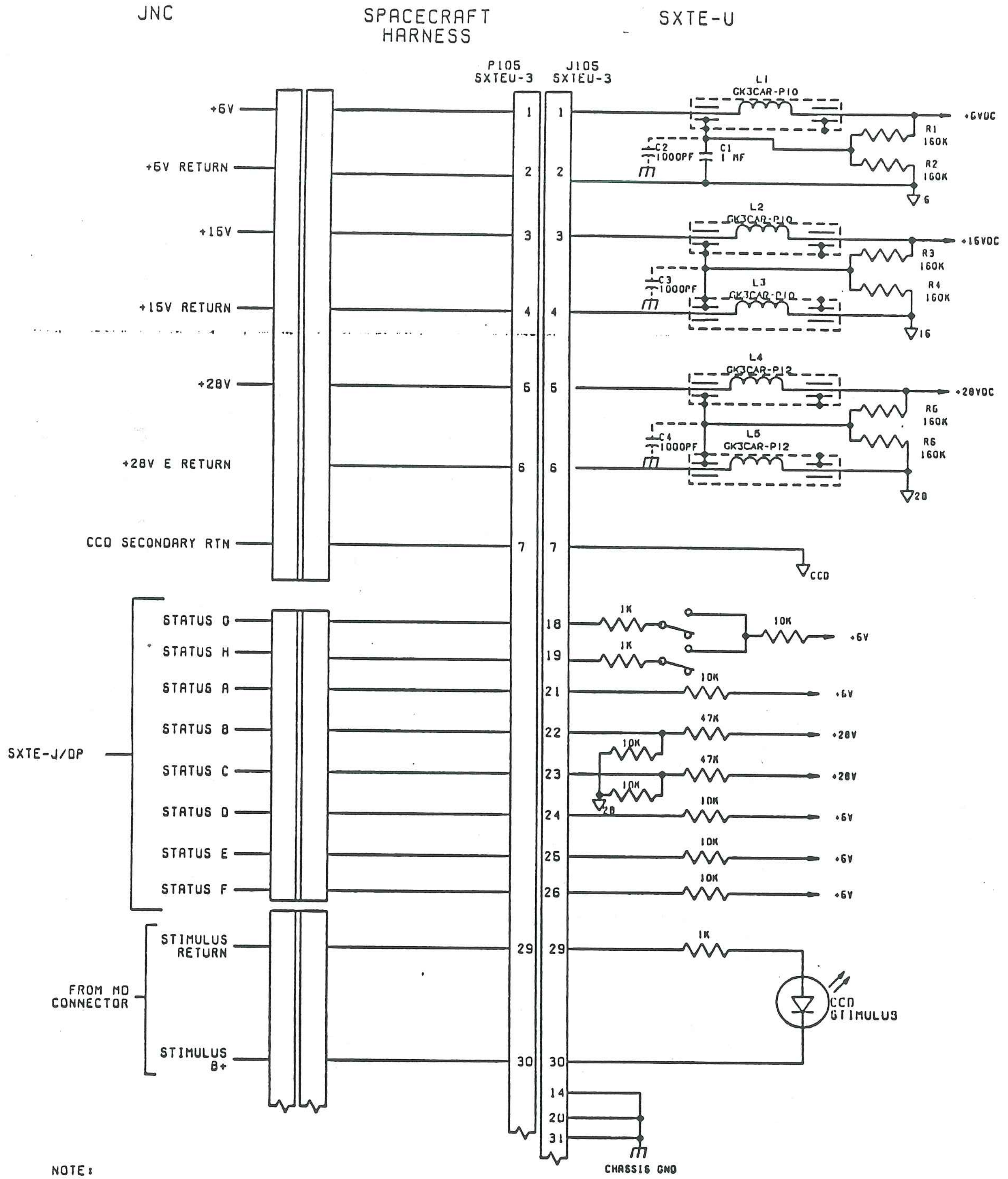
Figure 5.1-1 [SXT-2E038] SXTE-J/SXTE-U INTERFACE, POWER COMMAND



NOTE:

1. CONNECTOR PIN ASSIGNMENTS ARE FOR REFERENCE ONLY.
2. ALL POWER LEADS ARE 20 GAUGE UNSHIELDED.
3. STIMULUS LEADS ARE 22 GAUGE UNSHIELDED.
4. STATUS LEADS ARE 26 GAUGE UNSHIELDED.

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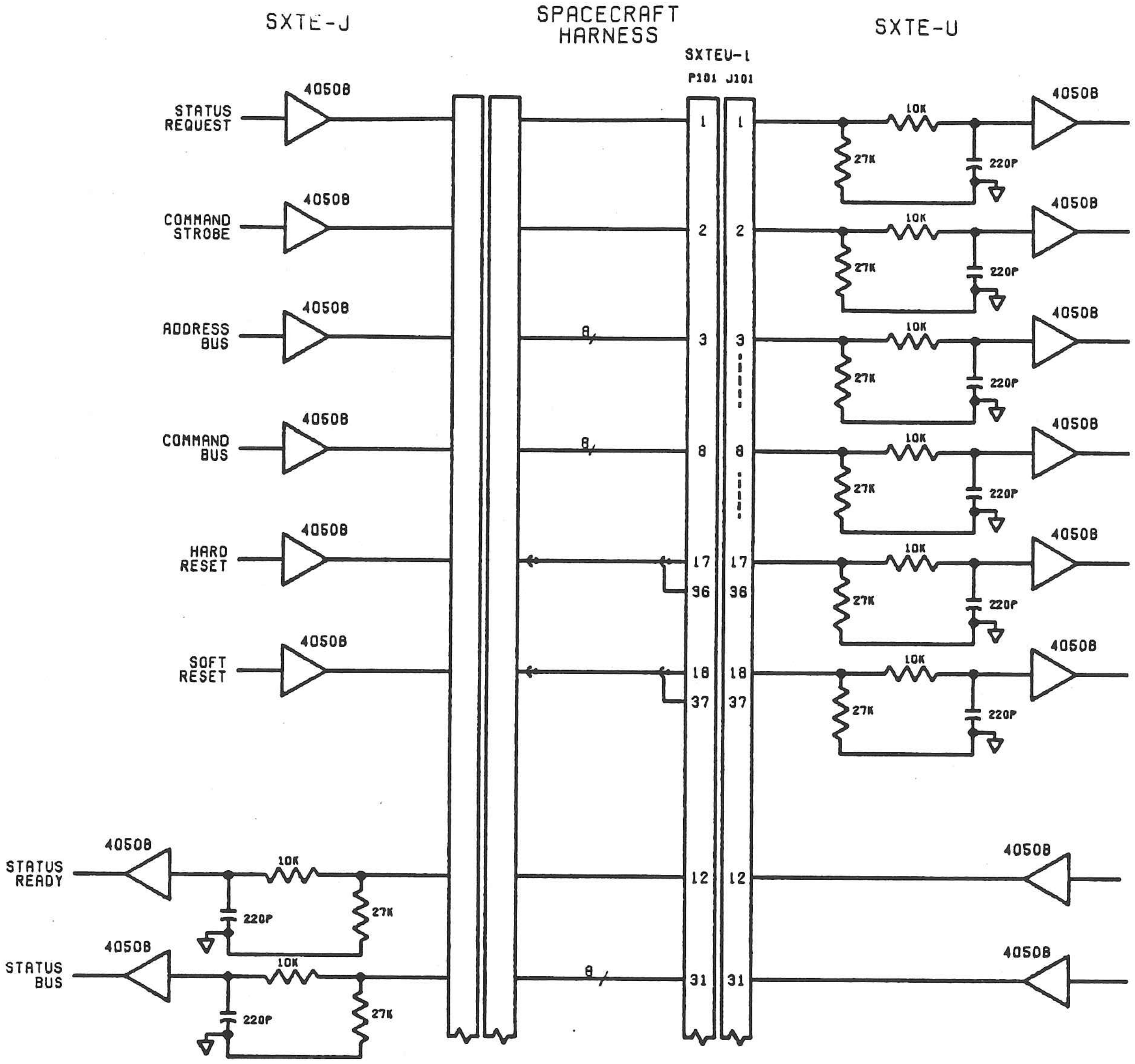
Figure 5.1-2 [SXT-2E041] SXTE-J/SXTE-U INTERFACE, POWER



NOTE:
1. CONNECTOR PIN ASSIGNMENTS FOR REFERENCE ONLY.
2. ALL LEADS BETWEEN SXTE-J AND SXTE-U ARE 28 GAUGE UNSHIELDED.

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Figure 5.1-3 [SXT-2E039] SXTE-J/SXTE-U INTERFACE, STATUS & COMMAND

5.1.2 Software Commands -

Operating commands to the SXT instrument are passed from SXTE-J/DP to the SXTE-U microprocessor subsystem via a command mailbox. The SXTE-U microprocessor configures the SXT peripherals and microprocessor state internally in response to those commands. Section 5.3 defines mailbox software interface and Appendix D provides more detail on the SXTE-U software.

5.1.3 DC And BC Commands -

The discrete (DC) and block (BC) commands to the DP, SXTE-J, and SXTE-U are received in the common command interface of the DP/SXTE-J. Only commands related to the SXTE-J and SXTE-U are listed here. All other DC commands are listed in DP/SXTE-J subsystem control document. The same DC matrix page, and BC instrument address should be allocated for the DP, SXTE-J, and SXTE-U. The DC command matrix and BC instrument address acronym is DP/SXT. These commands may be either sent directly from ground, or stored in the telemetry command unit (TCU) program memory.

5.1.3.1 DC Commands -

Table 5.1-2
SXT DC Commands -- DP/SXTE-J hardware control DC

X	Y	Command Name (B)=double command	Abbrev.	Description
4	0	OBJ heater auto control ENA	F-END AT ENA*	HCE OBJ heater control AUTO
4	1	OBJ heater auto control DIS	F-END AT DIS	HCE OBJ heater OFF
5	0	FPG heater auto control ENA	FPG AT ENA*	HCE FPG heater control AUTO
5	1	FPG heater auto control DIS	FPG AT DIS	HCE FPG heater OFF
7	0	TEC heater auto control ENA	TEC AT ENA	HCE TEC heater control AUTO
7	1	TEC heater auto control DIS	TEC AT DIS*	HCE TEC heater OFF
8	0	All Power OFF	ALL PWR OFF	All Status OFF
8	1	Main +28V Power ON	SXT 28 V ON	B ON
8	2	Main +15V & +5V Power ON	SXT 5 V ON	A & E ON, if system A is on A & F ON, if system B is on E & F are exclusive of each other. Check that G is OFF.
8	3	CCD Camera Power ON	CAMERA ON	G ON
8	4	FDE Power ON	FILTER ON	C ON
8	5	Shutter System Power ON	SHUTTER ON	D ON
8	6	TEC ON (B)	TEC ON	H ON
8	7	Select System A (B)	SELECT SYS A	E ON
8	8	Select System B (B)	SELECT SYS B	F ON
8	9	TEC OFF	TEC OFF	H OFF
8	A	Shutter System Power OFF	SHUTTER OFF	D OFF
8	B	FDE Power OFF	FILTER OFF	C OFF
8	C	CCD Camera Power OFF	CAMERA OFF	G OFF
8	D	5 V Backup	5V BACKUP	5V Backup Relay
8	E	28 V Backup	28V BACKUP	28V Backup Relay
8	F	Partial Power OFF	PART PWR OFF	ALL except B & H OFF (B & H does not change)
9	0	SXT Soft Reset (B)	SXT SOFT RST	Soft-reset SXTE-U
9	1	SXT Hard Reset (B)	SXT HARD RST	Hard-reset SXTE-U
A	2	SXT Control Auto	SXT CTL AUTO	SXT control auto
A	3	SXT Control Manual	*SXT CTL MANU	SXT control manual
A	4	SXTE-U RAM Buffer Read	SXT RBUF READ	Read SXTE-U RAM patch buffer (61 byte) to TLM
A	5	SXTE-U RAM Write	SXT RAM WR	Write data to SXTE-U RAM
A	8	SXT Table Write	SXT TABLE WR	Write data to SXT control table on SXTE-J memory
A	9	SXT Table Buffer Read	SXT TBUF RE	Read data of SXT Table Patch Buffer on SXTE-J memory
A	A	SXT Table Read	SXT TABLE RE	Read all data of SXT control table on SXTE-J memory
A	B	ART Data Initialization	ART INIT	Initialize ART information
A	C	SXT BDR Check Enable	*SXT BDR CHK ENA	BDR status check enable
A	D	SXT BDR Check Disable	SXT BDR CHK DIS	BDR status check disable
6	A	Power Control Manual	*SXT PWR MANU	SXT automatic power control manu
6	B	Power Control Auto	SXT PWR AUTO	SXT automatic power control auto
D	2	FFI protect enable	FFI PRT ENA	BDR FFI protection enable
D	3	FFI protect disable	*FFI PRT DIS	BDR FFI protection disable

NOTE: * = default mode

5.1.3.2 BC Commands -

Table 5.1-3
SXT BC Commands - SXT control command

Command Name	Command Code	Description
SXTE-J Entry table Update	81	Update Entry table, QT/Hi, QT/Med, FFI, PFI and SEQ table entry number
SXTE-U RAM read (61 bytes)	82	Read SXTE-U RAM data to patch buffer
SXTE-U RAM Buffer Write (1 to 61 bytes)	83	Write SXTE-U patch data to patch buffer
SXT Mailbox write	84	Mailbox write through BC window
SXT Mailbox Read	85	Mailbox read through BC window
SXTE-J Manual register Set	8A	Set SXTE-J parameters for manual operation Master Buffer, Full image ON/OFF, slave select, Summation mode
SXTE-J Table Buffer write (1 to 84 bytes)	8B	Write SXT table data with address and length specified by BC data
SXTE-J buffer dump	8C	Dump SXTE-J buffer, buffer number specified by BC data
SXTE-J buffer test	8D	Test SXTE-J buffer, buffer number specified by BC data

Table 5.1-4
SXT BC Commands

Command Name	BC Code	Command Data 01234567	Description
SXTE-J entry table update	81	------00	B6-7 00 = SEQ entry table 0
		------01	01 = SEQ entry table 1
		------10	10 = SEQ entry table 2
		------11	11 = SEQ entry table 3
		---000--	B3-5 000 = QT/Hi FFI SEQ
		---001--	001 = QT/Hi PFI SEQ
		---010--	010 = QT/Med FFI SEQ
		---011--	011 = QT/Med PFI SEQ
		---100--	100 = spare
		---101--	101 = FL/Hi PFI SEQ
		---110--	110 = spare
		---111--	111 = FL/Med PFI SEQ
SXTE-U RAM Read	82	XXXXXXXX	SXTE-U patch address (MSB)
		XXXXXXXX	SXTE-U patch address (LSB)
			Fixed data length = 61 bytes
SXTE-U RAM Buffer Write	83	XXXXXXXX	SXTE-U patch address
		XXXXXXXX	SXTE-U patch address
		00XXXXXX	Patch data length (1 byte)
		XXXXXXXX	Patch data (1 to 61 bytes)
			BC command length = data length + 3
SXTE-U Mailbox Write	84	00XXXXXX	Mailbox address for BC window access
		XXXXXXXX	Mailbox data for BC window Access
SXTE-U Mailbox Read	85	00XXXXXX	Mailbox address for BC window access
SXTE-J Manual Reg Set	8A	0-------	B0: 0 = Buffer 0 is master
		1-------	1 = Buffer 1 is master
		-0------	B1: 0 = partial frame imaging
		-1------	1 = full frame imaging
		--001---	B2-4: 001 = slave FBA select
		--010---	010 = slave FBB select
		--011---	011 = slave PBA select
		--100---	100 = slave PBB select
		--101---	101 = slave PTB select
		-----001	B5-7: 001 = sum mode full
		-----010	010 = sum mode half
		-----100	100 = sum mode quarter
		-----XXX	others = sum mode quarter (Turns BLS ON)
SXTE-J Table Buffer Write	8B	0XXXXXXX	Patch data length (1 - 84)
		XXXXXXXX	SXT control table address (L) *Three byte
		XXXXXXXX	SXT control table address (H) *pattern for
		XXXXXXXX	SXT control table Patch data *each data
			BC command length = (3 X data length) + 1
SXTE-J buffer dump	8C	0000XXXX	B4-7: 0001 = Buffer 0 FBA
			0010 = FBB
			0011 = PBA
			0100 = PBB

0101 = PTB
1001 = Buffer 1 FBA
1010 = FBB
1011 = PBA
1100 = PBB
1101 = PTB
others = Buffer 1 PTB

SXTE-J buffer test	8D	0000XXXX	B4-7: Same as 8C

5.1.3.3 SXT Status Word Data Format- -

Location: Minor frame 64n+25/Word 48
Data: Bi-level parallel power status monitor
Description:

Bit		Description
B0	SXPST-A	0: 5V/15V OFF 1: 5V/15V ON
B1	SXPST-B	0: 28V OFF 1: 28V ON
B2	SXPST-C	0: FDE OFF 1: FDE ON
B3	SXPST-D	0: Shutter OFF 1: Shutter ON
B4	SXPST-E	0: System A OFF 1: System A ON
B5	SXPST-F	0: System B OFF 1: System B ON
B6	SXPST-G	0: Camara OFF 1: Camera ON
B7	SXPST-H	0: TEC OFF 1: TEC ON

5.1.3.4 DC Command Telemetry Answerback -

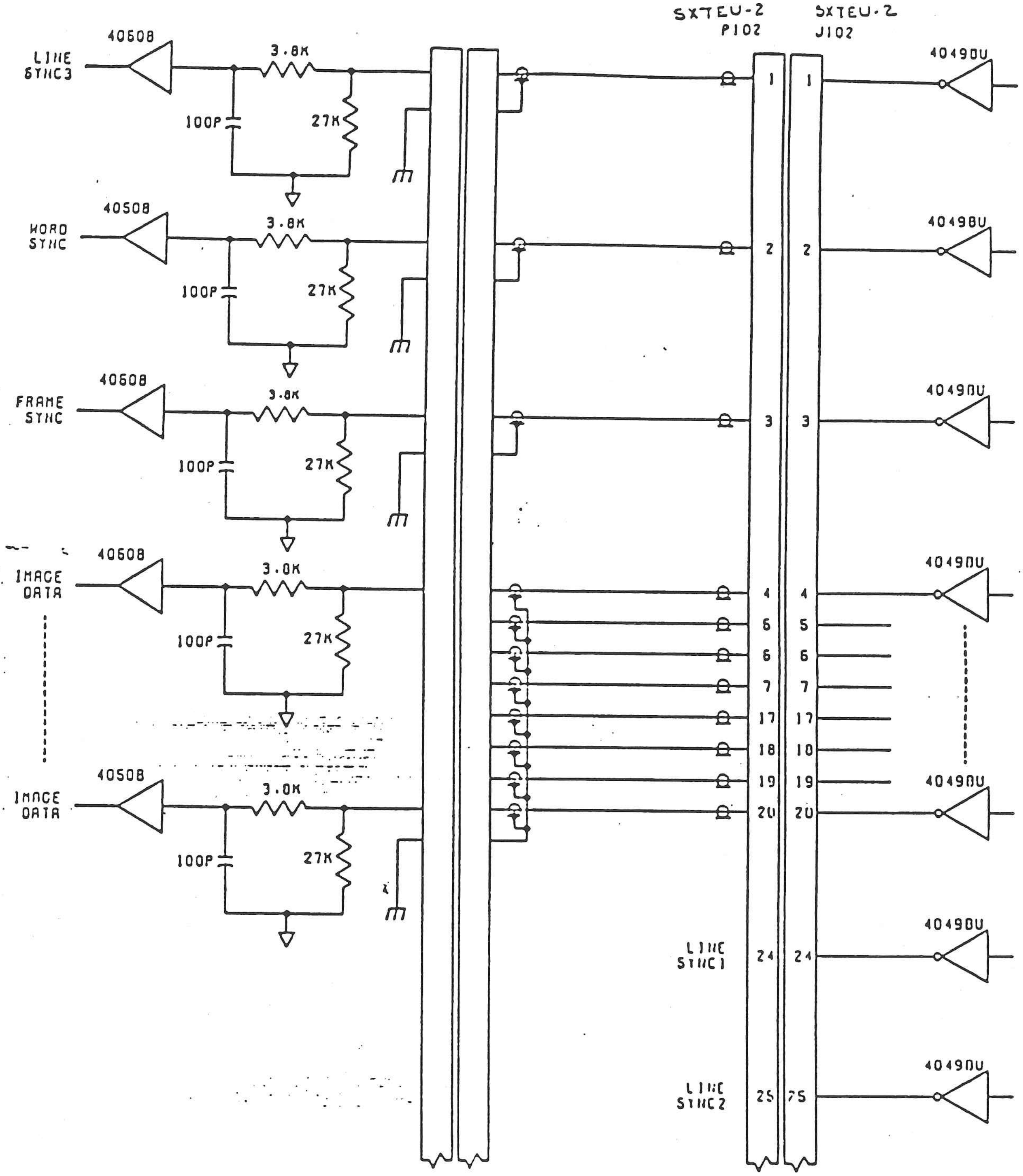
Table 5.1-5
DC command telemetry answer back

X	Y	Command	Telemetry answer F/W/B = Minor frame No./Word No./Bit No.
4	0	OBJ heater auto control ENA	F64n+14/B0=1
4	1	OBJ heater auto control DIS	F64N+14/B0=0
5	0	FPG heater auto control ENA	F64n+14/B1=1
5	1	FPG heater auto control DIS	F64N+14/B1=0
7	0	TEC heater auto control ENA	F64n+14/B3=1
7	1	TEC heater auto control DIS	F64N+14/B3=0
8	0	ALL POWER OFF	F25/W48/B0,1,2,3,4,5,6,7=0
8	1	28 V ON	F25/W48/B1=1
8	2	15V & 5 V ON	F25/W48/B0=1
8	3	CAMERA ON	F25/W48/B6=1
8	4	FDE POWER ON	F25/W48/B2=1
8	5	SHUTTER ON	F25/W48/B3=1
8	6	TEC ON	F25/W48/B7=1
8	7	SELECT SYSTEM A	F25/W48/B4=1,B5=0
8	8	SELECT SYSTEM B	F25/W48/B4=0,B5=1
8	9	TEC OFF	F25/W48/B7=0
8	A	SHUTTER OFF	F25/W48/B3=0
8	B	FDE POWER OFF	F25/W48/B2=0
8	C	CAMERA OFF	F25/W48/B6=0
8	D	5 V BACKUP	F25/W48/depends on other relay locations If B0=1, B0=0 If B0=0, B0=1
8	E	28 V BACKUP	F25/W48/depends on other relay locations If B1=1, B1=0 If B1=0, B1=1
8	F	PARTIAL POWER OFF	F25/W48/B0,1,2,3,4,5,6=0,B7=NO CHANGE
9	0	SXT SOFT RESET	F32/W114/B7=1
9	1	SXT HARD RESET	F32/W114/B6=1
A	2	SXT CONT AUTO	F32/W114/B1=1
A	3	SXT CONT MANU	F32/W114/B1=0
A	4	SXT BUFFER READ	F00/W115/B2=1, B3=1
A	5	SXT RAM WRITE	F00/W114/B7=1
A	8	SXT TABLE WRITE	F32/W114/B2=1
A	9	SXT TABLE BUFFER READ	F00/W115/B2=1, B3=0
A	A	SXT TABLE READ	F16/W114/B0=1, B1=0
A	B	ART DATA INIT	F12/W114/B7=1
A	C	SXT BDR CK ENB	F32/W114/B4=1
A	D	SXT BDR CK DIS	F32/W114/B4=0

5.2 Data Types And Characteristics -

5.2.1 Image Data Command Interface -

The image data hardware interface is shown in Figure 5.2-1 [SXT-2E040].



NOTE:
1. CONNECTOR PIN ASSIGNMENTS FOR REFERENCE ONLY.
2. ALL LEADS BETWEEN SXTE-J AND SXTE-U ARE 26 GAUGE SHIELDED.

Figure 5.2-1 [SXT-2E040] SXTE-J/SXTE-U Interface, Image Data

5.2.2 Image Data Type -

Each line of compressed data out of the camera has three types of data: (1) the line number; (2) base line stabilization (BLS) pixels; (3) and image data. The line number uses one byte. The BLS use 25 bytes, of which only approximately 20 bytes are valid. The image data comprise of 256, 512, or 1024 bytes (pixels) depending on the summation mode. See section 4.2.1.7.

The 12 bit words output by the CCD camera are passed across the interface in one of the following three ways: 1. low 8 bits 2. high 8 bits 3. compressed data

5.2.2.1 Compression Algorithm -

The SXT compression lookup table selected for programming into the FM PROMs was generated using the algorithm presented in SXT design note 37 and summarized below. Design note 37 extends and completes the work of SXT design notes 25 and 35.

SXT Compressed Data (12 bit -> 8 bit)

12 Bit Data	SXT 8 Bit Compressed
DN <= 64	CP = DN
DN > 64	CP = [(12.473 + SQRT(155.576 - 0.42104 * (431.14 - DN)))/.21052]

Where: CP = 8 bit compressed value
DN = 12 bit camera Data Number

5.2.3 Housekeeping Data -

Housekeeping (HK) data consists of nine (9) temperatures read directly by the spacecraft HK subsystem. The sensor numbers and locations are:

Sensor	Location
1	CCD Camera Head (Titanium case)
2	TEC Hot End on back of CCD Camera
3	Spacecraft End of TEC Thermal Shunt
4	Shutter Motor Case
5	Filter Wheel Housing
6	Aft Support Plate (filter wheel hub)
7	Metering Tube (center)
8	Mirror Assembly Mount or Forward Support Plate
9	Aspect Telescope Cell

In addition to the HK sensors the TEC Cold Junction CCD Camera temperature is transferred through SXTE-U mailbox. J-side is to provide thermal sensors of TL type (-50 degress C to +80 degrees C) and spares.

5.2.4 Temperature Sensors -

Sensor#	Location	Abbrev.	Range(C)	Resistance @20C(+/- 1%)	Telemetry Maj	Telemetry Min
1	CCD camera head(Ti case)	CCDHT	-50/+80	50 Ohms	2n+1	F26
2	TEC Hot End	TECT	"	"	2n+1	F25
3	TSA S/C End	TSAT	"	"	2n+1	F24
4	SM Case	STRT	"	"	2n+1	F23
5	FW housing	FW1T	"	"	2n+1	F22
6	FW hub	FW2T	"	"	2n+1	F21
7	MT center	MTT	"	"	2n+1	F18
8	Forward Sup plate	MRT	"	"	2n+1	F20
9	Aspect tel.	ATT	"	"	2n+1	F19

5.2.5 SXTS Heaters -

Location	Heater	Resistance @ 20C. Sensor (Thermister)	Turn-on Temp.	Turn-off Temp.
FPG	102 Ohms	5 KOhms	2.5+/-2 deg C	6.5+/-2 deg C
OBG	231 Ohms	5 KOhms	2.5+/-2 deg C	6.5+/-2 deg C
TSA	98 Ohms	5 KOhms	21.0+/-2 deg C	24.0+/-2 deg C

5.3 SXTE-U Control Memory And Mailbox Access -

The control memory and mailbox of SXTE-U constitutes part of the RAM in the microprocessor system. Commands from SXTE-J cause interrupts in SXTE-U's microprocessor system. An Interrupt Service Routine then deposits the commands into the mailbox and initiates control programs for the instrumentation accordingly. Periodically, SXT status information is read from the SXTE-U mailbox into an image of the mailbox in SXTE-J and from there into telemetry. Particular mailbox locations are defined as either status only, command only, or status and command. The layout of the mailbox is presented in Table 5.3-1. Detailed descriptions of the mailbox command and status values are presented in Appendix D.

Table 5.3-1: MAILBOX LAYOUT

AD = mailbox address
CS = command [C] / status [S] / comand and status [CS]

AD	CS	ITEM	DESCRIPTION (H=HEXADECIMAL) (b=BINARY) (X=DON'T CARE)
00H	C	SHUTTER MODE	00H=FT MODE 01H=SHUTTER MODE
01H	CS	FLUSH COUNT	CCCCBBAA AA =#FF FLUSHES PRE EXPOSE BB =#FF FLUSHES DURING SETUP/2 CCCC=#PRE ROI ROW FLUSHES
02H	C	DAY/NIGHT MODE	00H=NIGHT MODE 01H=DAY MODE
03H	CS	DESIRED FILTERS	XBBB XAAA XAAA = WHEEL A POSITION XBBB = WHEEL B POSITION
04H	C	ASPECT SENSOR COVER	00H=COVERED 01H=UNCOVERED
05H	CS	IMAGE RESOLUTION/ DATA COMPRESSION/ NUMBER OF ROI/ NUMBER OF EXPOSURES	DDCCBBAA BITS AA=IMAGE RESOLUTION 00b=FULL 01b=HALF 10b=QUARTER BITS BB=COMPRESSION MODE 00b=COMPRESS 01b=LOW 8 BITS ONLY 10b=HIGH 8 BITS ONLY BITS CC=NUMBER OF ROI 00b=1 ROI 01b=2 ROI 10b=3 ROI 11b=4 ROI BITS DD=NUMBER OF EXPOSURES 00b=1 EXPOSURE 01b=2 EXPOSURES @ 1 SECOND 10b=4 EXPOSURES @.5 SECOND
06H	CS	ROI 1 STARTING ROW	00H-0FFH
07H	CS	ROI 1 WIDTH	00H-0FFH

AD	CS	ITEM	DESCRIPTION (H=HEXADECIMAL) (b=BINARY) (X=DON'T CARE)
08H	CS	ROI 2 STARTING ROW	00H-0FFH
09H	CS	ROI 2 WIDTH	00H-0FFH
0AH	CS	ROI 3 STARTING ROW	00H-0FFH
0BH	CS	ROI 3 WIDTH	00H-0FFH
0CH	CS	ROI 4 STARTING ROW	00H-0FFH
0DH	CS	ROI 4 WIDTH	00H-0FFH
0EH	CS	EXPOSURE LEVEL	00H-021H
0FH	C	EXPOSURE COMMAND	00H=ABORT EXPOSURE 01H=START NORMAL EXPOSURE 02H=START DARK EXPOSURE 03H=START CALIBRATION
010H	S	STATUS1 CCD STATUS/ SHUTTER MODE/ SHUTTER STATUS/ ACTIVE SYSTEM/ DAY-NIGHT/ ASPECT COVER/	GFEDCBAA BITS AA=CCD STATUS 00b=IDLE 01b=EXPOSURE 10b=READOUT BIT B=SHUTTER MODE 0b=FT MODE 1b=MECHANICAL MODE BIT C=SHUTTER STATUS 0b=CLOSED 1b=OPEN BIT D=ACTIVE SYSTEM 0b=SYSTEM A 1b=SYSTEM B BIT E=DAY/NIGHT MODE 0b=DAY 1b=NIGHT BIT F=ASPECT COVER STATUS 0b=CLOSED 1b=OPEN BIT G=EXPOSURE 0b=NORMAL EXPOSURE 1b=ABORTED EXPOSURE

AD	CS	ITEM	DESCRIPTION (H=HEXADECIMAL) (b=BINARY) (X=DON'T CARE)
011H	S	STATUS 2 ACTUAL FILTER/ FILTER STATUS SETUP FLAG	DCBBBAAA AAA=WHEEL A POSITION BBB=WHEEL B POSITION C=FILTER STATUS 0b=NOT IN MOTION 1b=IN MOTION D=SETUP FLAG 0b=SETUP FINISHED 1b=SETUP IN PROGRESS
012H	CS	ERROR CODE 1	HGFEDCBA 1b=ERROR BIT A=FILTER SOFT ERROR BIT B=FILTER HARD ERROR BIT C=ASPECT SOFT ERROR BIT D=ASPECT HARD ERROR BIT E=SHUTTER ERROR BIT F=NIGHT COMMAND ERROR BIT G=INVALID MAILBOX ACCESS BIT H=MECHANISM MOVEMENT DETECTED NIGHT<>DAY
013H	S	CCD TEMPERATURE	00H-0FFH
014H	CS	FILTER SOFT ERROR COUNT	00H-0FFH
015H	CS	FILTER HARD ERROR COUNT	00H-0FFH
016H	CS	ASPECT COVER SOFT ERROR COUNT	00H-0FFH
017H	CS	ASPECT COVER HARD ERROR COUNT	00H-0FFH
018H	CS	SHUTTER ERROR COUNT	0H0-0FFH
019H	CS	INVALID MAILBOX ACCESS COUNT	00H-0FFH

AD	CS	ITEM	DESCRIPTION (H=HEXADECIMAL) (b=BINARY) (X=DON'T CARE)
01AH	CS	NIGHT COMMAND ERROR COUNT	00H-0FFH
01BH (HI) 01CH (LOW)	S	MEASURED EXPOSURE LATENCY	00H-0FFFFH
01DH (HI) 01EH (LOW)	S	MEASURED EXPOSURE DURATION	00H-0FFFFH
01FH	S	STATUS 4	XXXXCBBA A=IPL STATUS 0=IN PROGRESS 1=COMPLETE BB=ASPECT SENSOR ENCODER ECHO C=uP State 1=POST RESET 0=NORMAL X=SPARE BIT
020H	S	EXPOSURE RESOLUTION	00H-0FFH
021H	S	STATUS 3	CCBAAAAA AAAAA=SHUTTER ENCODER B=ENCODER FLAG 0=OK TO READ 1=NOT OK TO READ CC=CAMERA DATA TYPE 00=NO EXPOSURE SINCE NIGHT->DAY 01=NORMAL 10=DARK FRAME 11=CALIBRATION DATA
022H	CS	ERROR CODE 2	HGFEDCBA 1=ERROR BIT A=LINE SYNC 1 ERROR BIT B=FRAME GATE ERROR BIT C=BIT MAP ERROR BIT D=COLD RESET ERROR BIT E=WARM RESET ERROR BIT F=DATA RANGE ERROR BIT G=COMMAND BUFFER ERROR BIT H=1/.5 SECOND EXPOSURE SEQUENCE ERROR

AD	CS	ITEM	DESCRIPTION (H=HEXADECIMAL) (b=BINARY) (X=DON'T CARE)
023H	CS	READBACK TEST	00H-0FFH
024H	CS	WATCHDOG BYTE	00H-0FFH
025H (HI) 026H (LOW)	CS	RAM PATCH ADDRESS	00H-0FFFFH
027H	S	RAM PATCH READ	00H-0FFH
028H	C	RAM PATCH WRITE	00H-0FFH
029H (HI) 02AH (LOW)	S	COMMANDS SINCE RESET	00H-0FFFFH
02BH (HI) 02CH (MID) 02DH (LOW)	CS	SHUTTER MOVES SINCE RESET	00H-0FFFFFFH
02EH (HI) 02FH (MID) 030H (LOW)	CS	FILTER A MOVES SINCE RESET	00H-0FFFFFFH
031H (HI) 032H (MID) 033H (LOW)	CS	FILTER B MOVES SINCE RESET	00H-0FFFFFFH
034H (HI) 035H (LOW)	CS	ASPECT COVER MOVES SINCE RESET	00H-0FFFFH

5.3.1 Command Timing Requirements -

Table 5.3-2 lists the different actions that are required for normal SXT exposures.

Table 5.3-2
Possible Actions for Normal SXT Images

Determine:
1. Shutter mode
2. Data compression mode
3. Summation mode

Command:
4. Aspect door Open/Close
5. Filter wheel A move
6. Filter wheel B move
7. Full frame flush
8. Send CCD long command
9. Shutter Command
10. Fast line transfer (for ROI)
11. ROI Guard Band readout
12. Image readout

NOTE: The only difference for frame transfer images is that there is no shutter command required.

Table 5.3-3 shows the order and timing in which the SXTE-J/DP command and access the SXTE-U.

Table 5.3-3
Mailbox Access Sequence

Telemetry minor frame	command write NA = no access	status read NA = no access
00	exposure command/abort	NA
01	shutter mode	status 3
02	flush count	flush count
03	desired filters	desired filters
04	aspect sensor cover	status 1
05	NA	status 2
06	NA	error code 1
07	image res/comp/No of ROI	image res/comp/No of ROI
08	ROI 1 starting row	ROI 1 starting row
09	ROI 1 width	ROI 1 width
10	ROI 2 starting row	ROI 2 starting row
11	ROI 2 width	ROI 2 width
12	NA	status 1
13	NA	status 2
14	ROI 3 starting row	ROI 3 starting row
15	ROI 3 width	ROI 3 width
16	ROI 4 starting row	ROI 4 starting row
17	ROI 4 width	ROI 4 width
18	readback test	filter soft error
19	day/night mode	readback test
20	NA	status 1

21	NA	status 2
22	NA	error code 2
23	NA	filter hard error
24	NA	aspect cover soft error
25	NA	aspect cover hard error
26	NA	shutter error
27	NA	invalid mailbox access
28	NA	status 1
29	NA	status 2
30	NA	night command error
31	NA	commands since power on (HI)
32	NA	commands since reset (LOW)
33	NA	shutter travel since reset (HIGH)
34	NA	shutter travel since reset (MED)
35	NA	shutter travel since reset (LOW)
36	NA	status 1
37	NA	status 2
38	NA	error code 1
39	BC window	BC window
40	NA	filter A since reset (HIGH)
41	NA	filter A since reset (MED)
42	NA	filter A since reset (LOW)
43	NA	filter B since reset (HIGH)
44	NA	status 1
45	NA	status 2
46	NA	filter B since reset (MED)
47	NA	filter B since reset (LOW)
48	NA	aspect cover since reset (HIGH)
49	NA	aspect cover since reset (LOW)
50	NA	exposure resolution
51	NA	CCD temp.
52	NA	status 1
53	NA	status 2
54	NA	error code 2
55	NA	measured exposure latency(HI)
56	NA	measured exposure latency(LOW)
57	NA	status 4
58	exposure level (MBE)	exposure level (MBE)
59	NA	measured exposure time(LOW)
60	NA	status 1
61	NA	status 2 (setup complete?)
62	NA	measured exposure duration(HI)
63	NA	measured exposure duration(LOW)

Figures 5.3-1,-2 presents two different exposure sequence timelines. Table 5.3-4 lists the time required for some typical SXTE-U operations.

Figure 5.3-1 Typical Exposure ..eline (Using Fig 5.3-4 Typical Values)

```
Time (Seconds)           0.00        0.25        0.50        0.75        1.00        1.25        1.50        1.75        2.00
Minor Frame Number        00 02 04 06 08 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 00
                          ---------------------------------------------------------------------------------------------------
Shutter Mode Cmd            C
Flush Count                  C
Filter Wheel A move            C
Filter Wheel B move            C                                                     xxxxxxxxxxxx
Aspect Door Open/Close           C                                                   xxxxxxxxxxxxxxxxxxxxxxxxxxx
ROI setup Cmds                       CC CC C   CC CC
Generate CCD Long Cmd                   x [x]  [x][x]
Transmit CCD Long Cmd                                                                xxxxx
Perform Full Frame Flush                                                                  xxxxxxxxx
                          00 02 04 06 08 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 00
Setup? *=in progress      ***************************************************************************************     S
Set Exposure Time                                                                                                C
Exposure Start            C                                                                                               C
Pre Expose Flush          xx
Camera Integrate            xxxxxxxxxxxxxxxxxxxxxx
Fast Line Transfer                               x                                   x
ROI Bleed line readout                           xxxxxxxxxxxx
Image Readout                                                xxxxxxxxxxxxxxxxxxxxxxxxx
"Expos/Readout Period"    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
                          ---------------------------------------------------------------------------------------------------
Minor Frame Number        00 02 04 06 08 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 00
Time (Seconds)           0.00        0.25        0.50        0.75        1.00        1.25        1.50        1.75        2.00
```

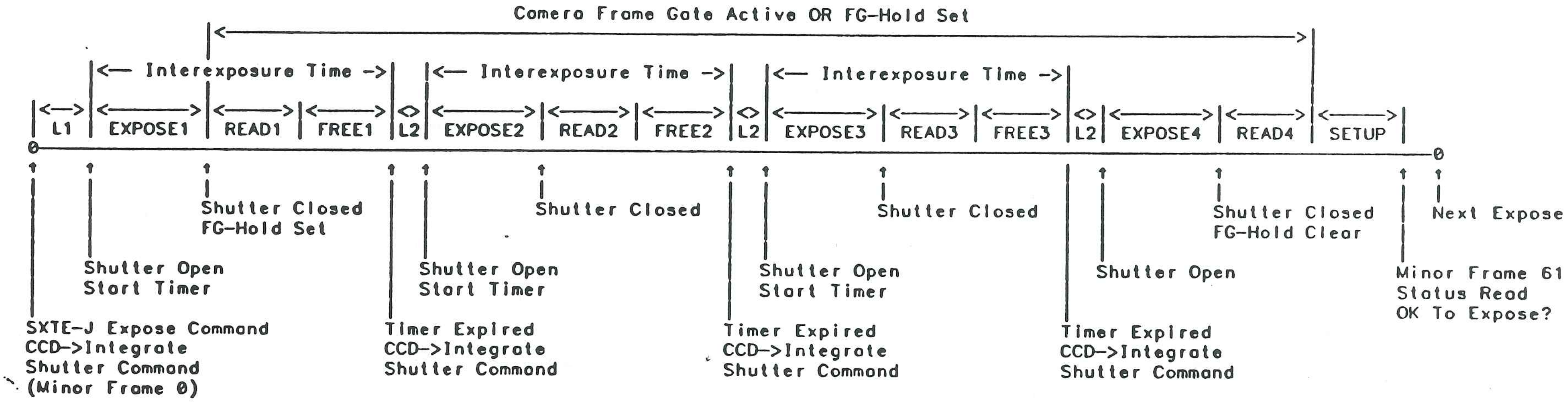
C = SXTE-J/DP command send S = SXTE-U setup query by SXTE-J/DP (Determine if exposure start may be issued nex minor frame 0)
x = SXTE-U microprocessor and peripheral commands/actions executed internally; [x] designates optional timing possibility
Notes: * Aspect door, filter wheels, camera flush and long word transmission cannot occur during "Expos/Readout Period"
* Timing of Full Frame Flush and Long Word Transmission are mutually exclusive (but can be concurrent with filter/aspect)
* Pre expose flushes contribute to exposure latency time by: (number pre flushes * 50 milliseconds)

Table 5.3-4 Times for Various SXTE-U Actions (seconds)

	Min	Max	Typical	
Filter Wheel move	0	1.0	0.580	(typical: A 60 deg / B 120 deg @240 Hz + settle)
Aspect Door Open/Close	0	0.260	0.260	
Generate CCD Long Cmd	0	0.030	0.030	(minimum if ROI commands = last commands)
Transmit CCD Long Cmd	0	0.100	0.100	(minimum if ROI commands = last commands)
Full Frame Flush	0	0.300	0.200	(maximum = 6 flushes, typical = 4 flushes)
Pre Expose Flush	0 / .200	0.150 / 0.350	0.050	(Mechanical/Frame Transfer mode min and max)
Exposure (Camera Integrate)	0.008 .008	241.00	0.468	(shutter open may be less than .008 Sec)
Fast Line Transfer	0	0.015	0.015	(max=960 lines, typ=960 lines)
ROI Bleed line readout	0	1.944	0.260	(max= 60 lines/ROI*4 ROI, typ=32 lines*1 ROI)
Image Readout	0.041	4.156	0.526	(max=512 lines, min=4 lines, typ=64 lines)

Note - Table applies to single exposure/major frame - some values may not apply to high time resolution mode.

Figure 5.3-2 SXT Half Second Exposure Timeline



Key:

FG—Hold = SXTE-U software/hardware Frame Gate 'simulator'
Timer = A SXTE-U harware timer (NSC810) used to time successive exposures while in the 1 and .5 second exposure modes.
Interexposure Time = Interval between a shutter open transition and initiation of subsequent exposure.
L1 = Mailbox Exposure Latency (EICA Appendix D) – interval between SXTE-J exposure command and first shutter open transition.
L2 = 'Interexposure Latency' – the interval between the expiration of the NSC810 timer and the next shutter open transition.
EXPOSEn = Interval between the shutter open and shutter close transitions (exposure duration).
READn = Time that the camera Frame Gate signal is active (camera reading out) for a given exposure.
FREEn = the interval between Frame Gate inactive transition and the end of Interexposure Time period.
SETUP = interval between the last Frame Gate inactive transition of a major frame (Readout 2 or 4) and minor frame 61.

5.3.2 Mailbox Access Agreements -

5.3.2.1 Exposure/Abort Exposure Command -

The start exposure/abort exposure command must be in the first minor frame of a command block. SXTE-J/DP will only issue the start exposure command if the SXTE-U setup-in-progress bit in mailbox Status2 is cleared by the last access of that location in the previous major frame (minor frame 61).

Upon receipt of an ABORT exposure command, any SXTE-U timed exposure in progress at the time will terminate, and normal camera readout will initiate. In addition, any pending mechanism commands are cleared. For aborted exposures, the exposure duration reported in the mailbox reflects the actual integration/shutter open time of the interrupted exposure. An abort exposure command will always be issued at the first minor frame zero following a mode change into flare or quiet mode.

5.3.2.2 Command Access During SXTE-U Night -

Certain SXTE-U commands are inhibited during SXTE-U night - those which only require microprocessor power are enabled to facilitate SXTE-U health monitoring and error recovery actions. Night command access is summarized as follows:

MB-Add(HEX)	Item	Command Access SXTE-U Night
00	Shutter Mode	Inhibited
01	Flush Count	Inhibited
02	Day/Night Command	Enabled!
03	Desired Filters	Inhibited
04	Desired Aspect Door	Inhibited
05	ROI Parameters	Inhibited
06 - 0D	ROI 1-4 Start/Width	Inhibited
0E	Exposure Level (MBE)	Inhibited
0F	Exposure Command	Inhibited
012	Error Code 1	Enabled
014 - 01A	Error Counters	Enabled
022	Error Code 2	Enabled
023	Readback Test	Enabled
024	Watchdog Test	Enabled
025 & 026	RAM Patch Address	Enabled
028	RAM Patch Write	Enabled
02B - 035	Peripheral Odometers	Enabled

5.3.2.3 Configuration Commands For Next Exposure -

All SXTE-U configuration commands may be issued during a single major frame according to the access sequence indicated in Table 5.3-3 and subject to access agreement 5.3.1.1 above.

5.3.3 High Time Resolution Mode -

Two special modes are defined to provide image time resolution of one second and half second. In these modes, SXTE-J provides a single start exposure command and SXTE-U handles the internal timing and commanding required to execute a sequence of two or four exposures, respectivly. The interface details for implementation of these modes are described in Appendix D.

Figure 5.3-2 illustrates a nominal timeline for execution of a .5 second exposure cadence. The timeline for the one second cadence would correspond to execution of the first and the last exposures in Figure 5.3-1 using double the Interexposure Time. The following comments generally apply to both modes:

or dark current

* These modes are only defined for shutter mode operation - frame transfer exposures are not permitted at the higher cadence.
* All exposures within a given major frame use the same exposure level.
* All exposures within a given major frame use the same filter wheel and aspect sensor cover positions.
* All exposures within a given major frame use the same camera long words for readout so the width and location of the ROI, number of lines in the guard band, and number of high speed parallel line shifts are equal. [This implies that in Figure 5.3-2, READ1 = READ2 = READ3 = READ4]
* The exposure duration reported in the mailbox reflects the duration of the most recent exposure.
* An error condition exists if the intervals labeled FREEn are negative - for example, the CCD camera is reading out when it is time to initiate the subsequent camera integration.
* Any setup commands received after the start of an exposure must be serviced before minor frame 61 [SETUP interval in Figure 5.3-2] to avoid a two second (minimum) gap in exposure cadence.

5.3.4 Camera Calibration -

A camera calibration mode is implemented within SXTE-U which allows production of light transfer calibration data from a single image. Table 5.3-5 outlines the mailbox command data required to implement this mode. Mailbox command and status access sequence is unchanged.

Table 5.3-5 Camera Calibration Setup

MINOR FRAME	MAILBOX COMMAND Location	Data	FUNCTION
01	00H	01H	Mechanical Shutter Mode
02	01H	04H *	Flush CCD Camera
03	03H	14H	Select Diffuser
04	04H	01H	Open Aspect Sensor Cover
07	05H	00H *	One ROI/Full Resolution/Compressed
08	06H	00H *	ROI start: CCD line 00
09	07H	7FH *	ROI width: 512 line readout
58	0EH	00H	Minimum exposure level
00	0FH	03H	Start Calibration (subject to 5.3.2.1)

H=HEX
*=data value may change

5.3.5 Error Reporting And Actions -

Two mailbox locations are maintained by the SXTE-U microprocessor to externalize various error conditions encountered. Reported errors include soft mechanism errors, hard mechanism errors, command errors, and processing errors. The meaning of the various errors reported in these locations are outlined in Tables 5.3-6 and 5.3-7. Error actions are presented in Table 5.3-8.

5.3.5.1 Error Reporting -

The Error Codes are represented in bit fields by HGFEDCBA where H and A represent the MSB and LSB respectively. Each bit defines a particular error condition as follows:

Table 5.3-6
SXTE-U Error Code 1 - Mailbox Location 012H

A : Filter wheel soft error - Set when the filter wheel(s) fail to reach the commanded position within the expected time.
B : Filter wheel hard error - Set when re-commanding the filter wheel a fixed number of times fails to position it to the commanded values (too many soft errors).
C : Aspect cover soft error - Set when the aspect cover fails to reach its desired state within the expected time.
D : Aspect cover hard error - Set when re-commanding the aspect cover a fixed number of times fails to position it to the desired state (too many soft errors).
E : Shutter Hard Error - Set when the SXT microprocessor fails to detect at least one Shutter Open transition within the expected time.
F : Night command error - Set when SXT receives an invalid command from the DP/SXTE-J while in night mode.
G : Invalid mailbox access - Set when SXT receives a status request or command request for a mailbox address which is not defined for that particular action - for example, a status request for an address which is not within the mailbox limits.
H : Uncommanded mechanism movement - Set during the transition from night to day mode when any mechanism position deviates from its expected (pre-night) value.

Table 5.3-7
SXTE-U Error Code 2 - Mailbox Location 022H

A : CCD Line Sync 1 error - Set if no LS1 signal is received by the microprocessor after a wait of 9 milliseconds.
B : CCD Frame Gate error - Set if Frame Gate signal does not appear within 9 milliseconds of camera readout or flush command.
C : CCD Map Error - Set if echo of camera bit map RAMs stored in the SXTE-U FIFO chip do not match long words transmitted.
D : ROM to RAM error - Set if cold reset copy of ROM contents into RAM results in a verification (checksum) error.
E : Warm Start Checksum Failure - set if there is one or more checksum compare failures during the Warm Start routine.
F : Mailbox Data Range Error - Set if the data byte associated with a valid mailbox command location fails data range checks.
G : Command Buffer Overflow - Set if there is no command buffer space to hold the current command.
H : Fast Cadence Processing Error - Set if SXTE-U could not properly execute a 1 second or .5 second exposure sequence.

5.3.5.2 Error Actions -

In addition to setting the appropriate bit in the Error Word, the following error actions will occur.

Table 5.3-8
SXTE-U/SXTE-J Error Actions

Error Bit(s)	SXTE-U Actions	Automatic SXTE-J Action
Code 1		
A and C	1) Increment Soft Error Counter 2) Re-command Mechanism	NONE
B,D and E	1) Increment Hard Error Counter 2) Safe Hold	1) SXT Control Off 2) SXTE-U Power -> Night (*)
F and G	1) Increment Error Counter	1) SXT Control Off
H	1) Position mechanism(s) to a predefined state.	NONE
Code 2		
A and B	1) Safe Hold	1) SXT Control Off 2) SXTE-U Power -> Night (*)
C	NONE	NONE
D and E	1) Safe Hold	NONE
F and G	NONE	1) SXT Control Off
H	1) abort current high cadence sequence	NONE

(*) SXTE-U Power -> Night = Shutter/Aspect Off, Filter Off, and Camera Off.

Note: Safe Hold is an SXTE-U microprocessor state which inhibits all commands to the affected mechanism while allowing detailed analysis of the pre-error and current system status.

5.3.6 SXTE-U Initialization -

5.3.6.1 Reset -

Upon completion of a HARD or SOFT reset operation, all mailbox status requests will return a zero with the following exceptions:

Mailbox Item	Mailbox Address	Status Return	Interpretation
Status 4	1F	09	IPL Complete and Post Reset State
RAM Read	27	C3	Contents of SXTE-U ROM address 00
Status 1	10	XX	Shutter open and system select fields reflect the actual state of the internal line as read by the uP (Shutter open undefined if shutter power is off.)

5.3.6.2 First DAY Command -

After the first DAY command following a reset, the following mailbox status locations are initialized to reflect internal SXTE-U system initialization:

Mailbox Item	Mailbox Address	Status Return	Interpretation
ROI Param	05	01	1 Exposure/ 1 ROI / Compressed / Half Resolution
ROI Width	07	FF	Full CCD coverage (512 lines out at 2x2)
Exp Level	0E	02	18 millisecond exposure
Status 1	10	XX	Aspect door field updated to indicate position
Status 2	11	XX	Updated with actual filter wheel position.
Status 4	1F	00000xx1b	xx=updated with actual aspect door encoder data SXTE-U uP state Normal (changed from Reset)

(Note: all numbers are HEX except Status 4 Return which is binary.)

5.3.7 SXTE-U Post Reset State -

Following a HARD or SOFT reset, the SXTE-U microprocessor enters a special post reset state. This state allows certain peripherals to be powered individually and commanded to verify function without flagging errors for un-powered peripherals. This contrasts to normal DAY operations when all peripherals are assumed powered - the SXTE-U microprocessor has no direct visibility of peripheral power status. The post reset state is terminated when SXTE-U recieves the first DAY command following the reset. After that initial state transition, the post reset state is only restored when another reset operation is executed. Such resets occur either on power up of +5 V logic or via discrete command from SXTE-J/DP. The first planned use of the post reset state is to perform the initial post launch checkout of SXTE-U.

5.3.8 Exposure Duration / Exposure Resolution Interpretation -

The actual SXTE-U exposure duration is related to the mailbox exposure duration and associated mailbox exposure resolution by:

Actual Exposure Duration (ms) = MED * (32^MER) * .0016

Where MED = 16 bit mailbox exposure duration - address 01DH(MSB)/ 01EH(LSB)
MER = 8 bit mailbox exposure resolution - address 020H
^ = exponentiation
* = multiplication.

5.3.9 Exposure Latency Interpretation -

The actual exposure latency (described in Appendix D) is related to the mailbox exposure latency by:

Actual Exposure Latency (ms) = MEL * .0016

16*16
= 256

Where MEL = 16 bit mailbox exposure latency - address 01BH (MSB) / 01CH (LSB)

5.3.10 Mailbox Temperature Word / Camera Temperature Relationship -

The actual CCD cold junction temperature is related to the value reported in the mailbox by the following polynomial:

Camera Temperature = -2.8327 E+01 * (MBTMP*16)^00
(degrees C) + 9.76136E-03 * (MBTMP*16)^01
+ -1.31384E-05 * (MBTMP*16)^02
+ 1.17453E-08 * (MBTMP*16)^03
+ -4.08284E-12 * (MBTMP*16)^04
+ 5.18359E-16 * (MBTMP*16)^05

Where MBTMP=8 bit mailbox camera temperature word in maibox location 013H.

5.3.11 SXTE-U Night Actions - Photon Flood Configuration -

Upon receipt of the mailbox NIGHT command, the SXTE-U microprocessor performs the following actions.

1. Exposure in progress is terminated and normal camera readout is initiated (if applicable),
2. Any pending peripheral peripheral commands are cancelled,
3. The SXT peripherals are configured to allow low energy photon irradiation of the CCD ('photon flood'):
    1. Aft filter (B) is positioned to OPEN and Forward filter (A) is positioned to Quartz photon flood defocusing lens,

2. Shutter is opened (Shutter Mode is Frame Transfer,)
3. Aspect Sensor Door is opened.

This SXTS configuration is the most beneficial for reversing increased CCD dark current caused by exposure to soft x-rays. Configuring SXTS during the transition from day to night permits some photon flooding of the detector at times when normal operations are suspended (immediately preceding and following Solar-A orbital night) thus minimizing the impact to science objectives.

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CHAPTER 6

SOFTWARE

6.1 Types Of Software Requirements -

The purpose of this section is to describe the various types of software required for the SXT experiment and to define which side (Japanese or U.S.) is responsible for its preparation, documentation, and maintenance. The detailed software requirements that require interface or agreement between the two sides is included in Appendix D and F, and detailed software specifications are included in Appendix E.

At a minimum, the following computers require software for SXT:

Flight:	
SXTE-U micro	Micro processor(s) within SXTE-U.
SXTE-J micro	Micro processor(s) within SXTE-J.
Ground:	
SD-1	Computer at KSC, or others like it used for test at ISAS.
SD-1'	Computer used at ISAS for SOLAR-A proto-model tests.
M-S	Mainframe Fujitsu computer at Sagamihara campus.
JVAX	U.S. Micro-VAX SXT analysis system in Japan.
UVAX	Micro-VAX SXT analysis system in U.S.
SXTE-J emulator	Fujitsu-based interface tester.
DSTS	Data System Test Set, IBM PC AT-class SXT tester.
CSTS	Camera System Test Set, IBM PC AT-class CCD camera tester.

6.1.1 Flight Software -

Type of Software	Machine	Responsibility
SXT instrument	SXT micro	US
SXT software	SXTE-J	Japan

6.1.2 Ground Operations Software -

Type of Software	Machine	Responsibility
SXT command generation software	SD-1 or M-S	Japan
Quick look (QL) software	SD-1 or M-S	Japan
Delayed look (DL)-Batch software	SD-1 or M-S	Japan
SXT engineering analysis code	M-S or SD-1	Japan/US
SXT scientific analysis code	M-S	Japan
M-S/JVAX hardwire data transfer code	M-S & JVAX	US/Japan
SXT engineering analysis code	JVAX or UVAX	US
SXT scientific analysis code	JVAX or UVAX	US

6.1.3 SXT Test Software -

Type of Software	Machine	Responsibility
SXT command and status monitor	SXTE-J emulator	Japan
SXT data system test set	DSTS	US
SXT camera system test set	CSTS	US
Electronic proto-model software	SXTE-J	Japan
Electronic proto-model test software	SD-1' computer	Japan
Flight model QL & DL software	SD-1 & M-S	Japan
"GSE port" SXT micro test software	DSTS	US

CHAPTER 7

ENVIRONMENTS

7.1 Design Qualification Requirements -

7.1.1 Subsystem Level -

7.1.1.1 Shock -

Z Axis (Thrust) : 25 G, 10 msec, half-sine-wave once.

7.1.1.2 Random Vibration -

The vibration spectrums for the Flight Model X-ray Mirror, the FDE electronics box, and the SXTE-U electronics box subsystem level tests are given in Table 7.1-1A. The vibration spectrums for the SXTS and CCDE/P subsystem level tests are given in Table 7.1-1B.

The vibration spectrums in Table 7.1-1A are the original vibration spectrums, the lateral axes spectrum in Table 7.1-1B is revised from the original based on the accelerometer results from the structural test performed in Japan. The reason that the different electronic boxes are vibrated to different spectrums is that the CCDE/P box is mounted near the SXTS aft end, whereas the SXTE-U and FDE boxes are mounted on a side panel.

Table 7.1-1A
Random Vibration - Original Subsystem Level

Thrust Axis (Z) (14.86 G rms) (Electronic boxes shake - 30 sec) (Flight Model mirror shake - 10 sec)		Lateral Axes (X, Y) (19.78 G rms) (Electronic boxes shake - 30 sec) (Flight Model mirror shakes - 10 sec)	
Frequency (Hz)	Level	Frequency (Hz)	Level
20	0.1256 G^2/Hz	20 - 35	0.53 G^2/Hz
20 - 40	+6 dB/oct	35 - 150	-6 dB/oct
40 - 116	0.5 G^2/Hz	150	0.029 G^2/Hz
116 - 235	-12 dB/oct	150 - 600	+6 dB/oct
235 - 541	0.03 G^2/Hz	600 - 900	0.48 G^2/Hz
541 - 750	+12 dB/oct	900 - 2000	-12 dB/oct
750 - 2000	0.11 G^2/Hz	2000	0.0198 G^2/Hz

Table 7.1-1B
Random Vibration - Revised Subsystem Level

Thrust Axis (Z) (30 sec, 14.86 G rms)		Lateral Axes (X, Y) (30 sec, 14.78 G rms)	
Frequency (Hz)	Level	Frequency (Hz)	Level
20	0.1256 G^2/Hz	20	0.095 G^2/Hz
20 - 40	+6 dB/oct	20 - 25	-18 dB/oct
40 - 116	0.5 G^2/Hz	25 - 97	0.025 G^2/Hz
116 - 235	-12 dB/oct	97 - 160	+18 dB/oct
235 - 541	0.03 G^2/Hz	160 - 190	0.5 G^2/Hz
541 - 750	+12 dB/oct	190 - 345	-6 dB/oct
750 - 2000	0.11 G^2/Hz	345 - 1010	0.152 G^2/Hz
		1010 - 2000	-12 dB/oct
		2000	0.01 G^2/Hz

7.1.1.3 Thermal Vacuum Test -

A thermal vacuum test will be performed as part of SXT experiment qualification in the U.S. The definition of this test is as follows:

The temperature spectrum for the SXT thermal vacuum test is given in Figure 7.1-1. Functional checks shall be performed at the test points shown in Figure 7.1-1. The instrument will be tested with both SXTS and the electronics boxes inside the chamber. Feed-through cables will connect the instrument with the GSE outside the chamber.

7.1.2 System Level -

Testing of SXT flight model instrument as part of Solar-A in Japan.

7.1.2.1 Shock -

Z Axis Direction: 15 G, 10 msec, half-sine-wave twice.

Table 7.1-2
Random Vibration - System Level

(Along Z axis) thrust axis (30 sec, 3.55 G rms)		(Lateral axes) (30 sec/1 axis, 4.85 G rms)	
Frequency (Hz)	Level	Frequency (Hz)	Level
20 - 40	0.08 G^2/Hz	20	0.02 G^2/Hz
40 - 127	-12 dB/oct	20 - 99	-6 dB/oct
127 - 435	0.0008 G^2/Hz	99	0.000824 G^2/Hz
435 - 750	+12 dB/oct	99 - 600	+6 dB/oct
750 - 2000	0.007 G^2/Hz	600 - 900	0.03 g^2/Hz
		900 - 2000	-12 dB/oct
		2000	0.00124 g^2/Hz

7.1.2.2 Thermal Test -

The preliminary definition of this test is as follows:

The test will require 24 hours. Temperature cycle a minimum of 1 1/2 times between 45 deg C and -20 deg C with dwells at -10,-20 deg C and 20, & 45 degC for 2 to 5 hours to achieve stability (See Figure 7.1-2 [SXT-20008] for profile, which is Figure 3.2-3 of Solar-A-103) followed by an electrical Functional Test. The last half cycle shall be at elevated temperature.

At each temperature dwell, the SXT is to be functionally tested.

7.1.2.3 Vacuum Test -

A vacuum test will be performed as part of Solar-A testing in Japan. As part of the vacuum test, a simulated orbit operation will be performed. Also, as part of the vacuum test, thermal balance of the SXT in the payload will be determined.

7.1.3 Transportation Environment (to KSC) -

Temperature: 10-40 C
Humidity: 50% (30% would be preferable)
Vibration Shock: less than 1.5 G's for each axis
Cleanliness: almost as clean as normal clean room
Pressure: atmospheric pressure
Sealed container.
Nitrogen purge is available prior to transportation but not during transportation.

Trip takes approximately 24 hours.

7.2 Launch Environment -

7.2.1 Environment On The Launcher -

The launch process will be as follows:
While the launch vehicle with spacecraft is within the service tower at KSC, an air-conditioner will keep their temperature at about 20 + or -5 degree C. The launch vehicle will be taken out to the launch-pad about two hours before the take-off. From this time on, the vehicle will be exposed to the external atmosphere. Dry N2 purge may continue until take-off if it is desired. After launch, the payload compartment inside the nose-fairing will be quickly evacuated within about 60 sec. SXT will experience most severe shock and vibration at the instance of first stage ignition and during the first stage burning which will continue for about 60 sec. The second and the third stage burning will follow for about eight minutes. During the course of these events, a slight cooling due to adiabatic expansion of the air and a slight heating due to dynamic pressure can be expected. However, since the heat capacity of the spacecraft is so large, estimates are that there will be no significant temperature variation inside the spacecraft. Expected temperature of SXT will be within 20 + or - 10 degree C.

7.2.2 Pump Down Profile -

See Figure 7.2-1 for the pump down profile.

7.2.3 Static And Quasi Static Load -

		THRUST	LATERAL
STATIC LOAD	1st stage burning	7G	5G
	3rd stage burning	15G	0G

7.2.4 Acoustic Environment -

Third-Octave-Band Sound Pressure Level for Mu-3S-II Payloads
(At Level, dB Ref. 2x10E-5 N/m sq.)

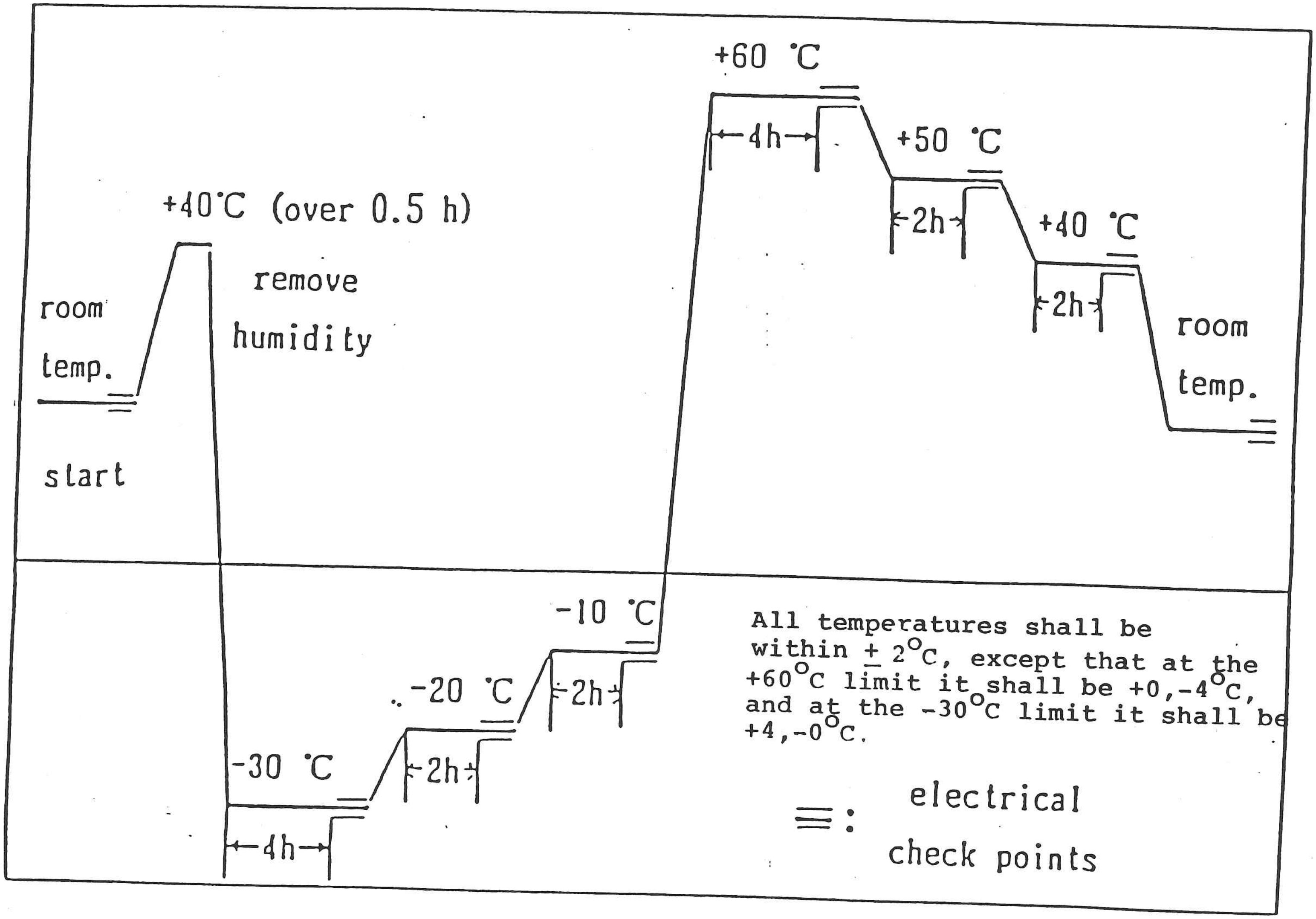
One-Third-Octave Center Frequency (Hz)	Maximum Measured Level (dB)
31.5	125.7
40	123.7
50	122.6
63	123.2
80	125.4
100	129.1
125	129.1
160	129.1
200	129.1
250	130.7
315	133.3
400	134.4
500	130.7
630	128.1
800	128.1
1000	126.6
1250	126.6
1600	123.3
2000	120.5
2500	116.4
3150	115.6
Overall	141.6

Test Duration 5 sec

Comment: QT level should be 3dB higher than AT level with test duration of 15 sec.

Hardware should be designed for QT level.

Temperature test (sub-system level)



All temperatures shall be within ± 2°C, except that at the +60°C limit it shall be +0,-4°C, and at the -30°C limit it shall be +4,-0°C.

Figure 7.1-1 [SXT-20007] Thermal Test Profile - Subsystem Level

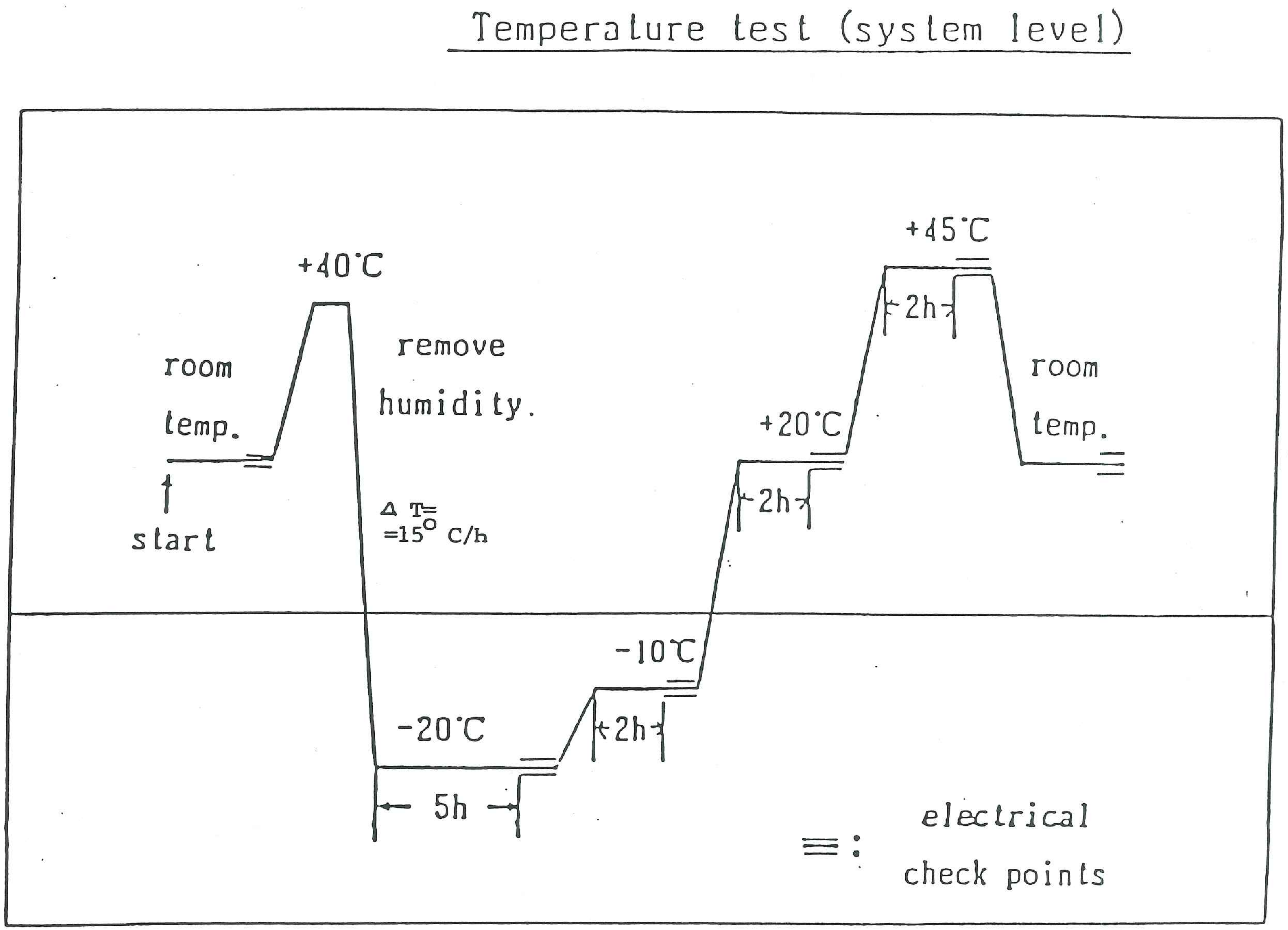


Figure 7.1-2 [SXT-20008] Thermal Test Profile - System Level

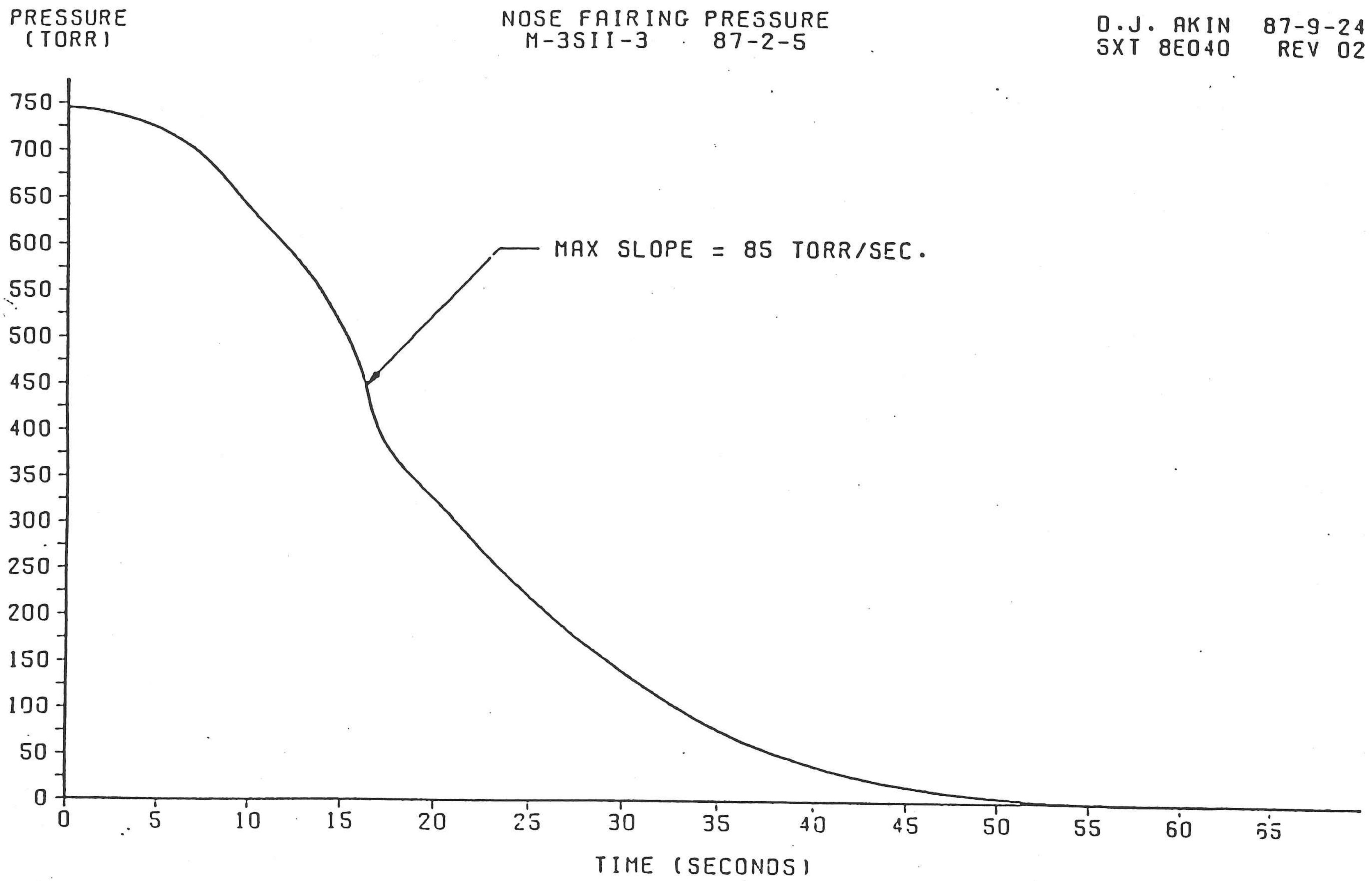


Figure 7.2-1 [ ] Pump Down Profile

7.3 Orbital Environment -

7.3.1 Orbit -

Altitude: 600 km; circular
Inclination: 31 deg

7.3.2 Radiation Environment -

The following 24 hour integrated radiation belt fluxes are computed by Mr. E. E. Gaines of LPARL for solar maximum conditions and an orbit of 600 km altitude and 31 deg inclination.

Table 7.3-1
Proton Flux

ENERGY RANGES (MEV) E1 - E2	AVERAGED FLUX ABOVE E1 (PER DAY)	AVERAGED INTEGRAL FLUX IN ENERGY BAND E1 - E2 (PER DAY)	PERCENT
4.00- 6.00	7.11E + 06	2.05E + 05	2.88
6.00- 10.00	6.90E + 06	4.13E + 05	5.82
10.00- 15.00	6.49E + 06	3.28E + 05	4.62
15.00- 30.00	6.16E + 06	7.82E + 05	11.00
30.00- 50.00	5.38E + 06	7.93E + 05	11.17
50.00- 70.00	4.58E + 06	7.15E + 05	10.06
70.00- 90.00	3.87E + 06	5.92E + 05	8.34
90.00- 110.00	3.28E + 06	5.37E + 05	7.56
110.00- 150.00	2.74E + 06	8.69E + 05	12.22
150.00- 200.00	1.87E + 06	6.96E + 05	9.79
200.00- 250.00	1.18E + 06	4.63E + 05	6.51
250.00- 300.00	7.13E + 05	2.78E + 05	3.92
300.00- 350.00	4.35E + 05	1.68E + 05	2.37
350.00- 400.00	2.67E + 05	1.03E + 05	1.45
400.00	1.64E + 05		2.31

Table 7.3-2
Electron Flux

ENERGY RANGES (MEV) E1 - E2	AVERAGED FLUX ABOVE E1 (PER DAY)	AVERAGED INTEGRAL FLUX IN ENERGY BAND E1 - E2 (PER DAY)	PERCENT
0.10- 0.15	1.29E + 10	4.67E + 09	36.09
0.15- 0.20	8.26E + 09	2.95E + 09	22.82
0.20- 0.30	5.31E + 09	3.23E + 09	24.95
0.30- 0.40	2.09E + 09	1.32E + 09	10.18
0.40- 0.50	7.71E + 08	4.86E + 08	3.76
0.50- 0.60	2.85E + 08	1.16E + 08	0.90
0.60- 0.70	1.70E + 08	6.70E + 07	0.52
0.70- 0.80	1.03E + 08	3.44E + 07	0.27
0.80- 1.00	6.83E + 07	3.23E + 07	0.25
1.00- 1.25	3.59E + 07	1.39E + 07	0.11
1.25- 1.50	2.20E + 07	8.48E + 06	0.07
1.50- 2.00	1.36E + 07	7.53E + 06	0.06
2.00- 2.50	6.03E + 06	3.25E + 06	0.03
2.50- 3.00	2.78E + 06	2.30E + 06	0.02
3.00- 3.50	4.74E + 05	4.27E + 05	0.00
3.50- 4.00	4.67E + 04	4.43E + 04	0.00
4.00- 4.50	2.43E + 03	2.43E + 03	0.00
4.50- 5.00	0.00E + 00	0.00E + 00	0.00
5.00	0.00E + 00		0.00

Table 7.3-3
SXT Radiation Environment

Shield Thickness (inches, Al)	Dose in Silicon (Rads/year)
.014	2.2 E04
.029	3.2 E03
.044	1.4 E03
.058	8.7 E02
.087	5.5 E02
.117	4.1 E02
.146	3.6 E02
.175	3.1 E02
.204	2.8 E02
.233	2.7 E02
.292	2.4 E02
.364	2.2 E02
.437	2.1 E02
.510	1.9 E02
.729	1.6 E02

CHAPTER 8

TEST, INTEGRATION AND LAUNCH

The purpose of this section is to specify the equipment and procedures to be used for testing the SXT experiment in Japan.

8.1 Ground Support (GSE) And Electrical Checkout Equipment (ECE) -

8.1.1 ECE Wiring Harness Block Diagram -

| The section and Figure 8.1-1 are deleted.

8.1.1.1 ECE Provided By U.S. Side For PM And FM -

The ECE will consist of the following units:

- Data System Test Set (DSTS) (2) PC AT-Class Computer
  - Printer
  - Serial Buffer Box
  - EPROM Burner
- CCD Camera System Test Set (CSTS) PC AT-Class Computer
  - Image display monitor
  - Optical Disk Drive
- | CCD Camera (Engineering Model when in ECE)
  - CCDE/CCDP/CCDH
  - CCD Power supply
  - Camera Simulator
  - Lens and bellows
- | SXTE-U (Engineering Model when in ECE)
  - Filter Drive Electronics and Filter Wheel Assembly
  - Shutter
  - Aspect Door
- Power Converter

8.1.1.2 ECE Provided By Japanese Side -

- SXTE-J Emulator, designed to run on 100 Vac, +/- 10%, 50-60HZ, 1.5 KVA

- Power source to operate the SXTE-U.

8.1.2 GSE Provided By U.S. Side -

- SXT Instrument Handling Fixture

  The SXT lifting fixture is shown in Figure 8.1-2 [SXT-40023].

- SXT Transport and Handling Plate

  The SXT transport and handling plate will be the drilling template. (see Figure 2.5-2)

- SXT GN2 Purge System

  The Gaseous Nitrogen Purge System is shown schematically in Figure 8.1-3. The detail in that figure shows the attachment point and mechanism for directing the gas into the SXT. A GN2 Purge Operations Procedure is provided in Section 8.3.2.1.

8.1.3 GSE Provided By Japanese Side -

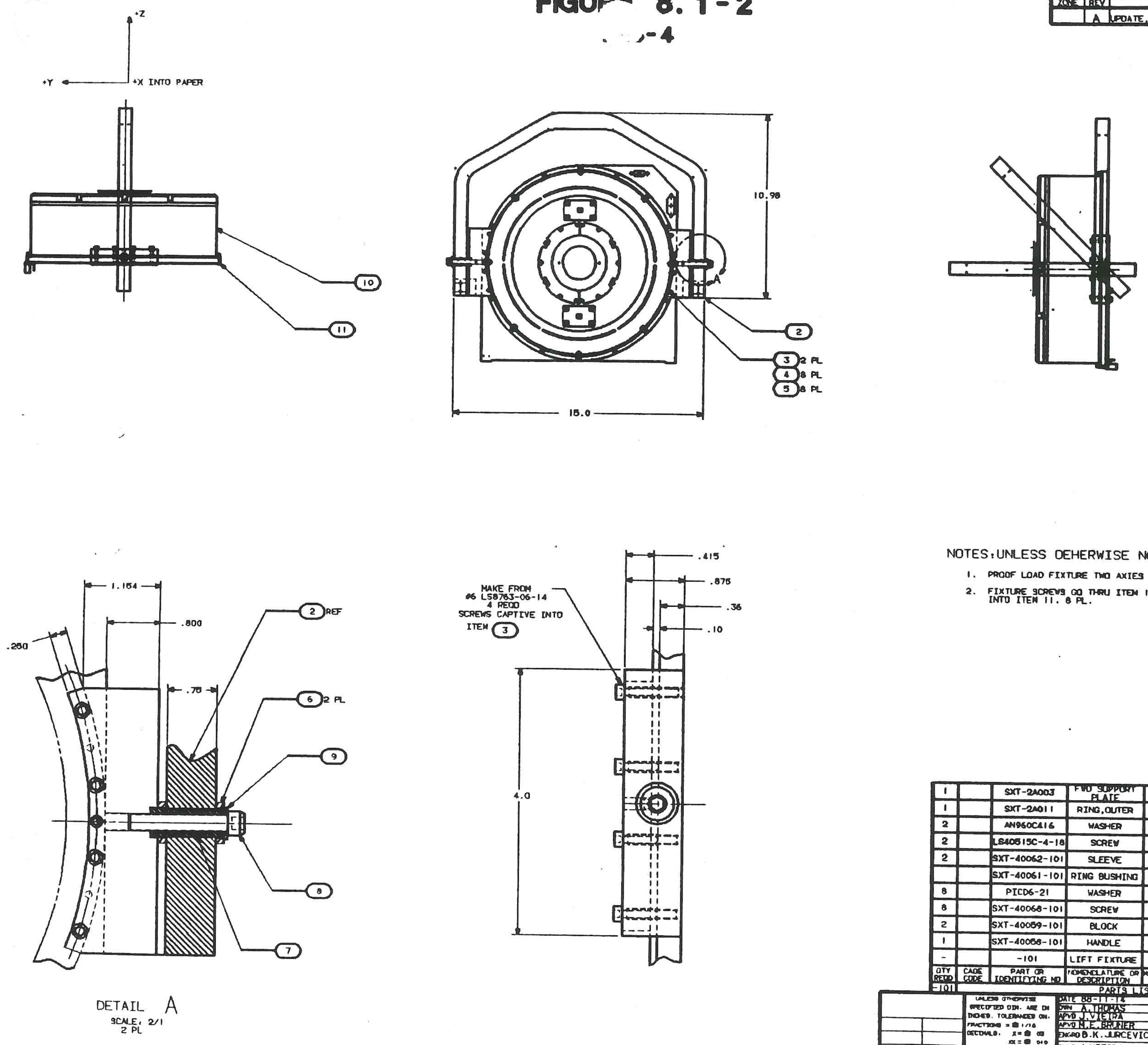
- Optical (white light) collimator:
  Collimator Diameter =31 cm

Figure 8.1.1 is deleted.

ZONE	REV	DESCRIPTION	DATE	APVD
	A	UPDATE, ADD	25APR90	BKJ

FIGUR 8.1-2

-4



NOTES: UNLESS OEHERWISE NOTED.

1. PROOF LOAD FIXTURE TWO AXIES -Y, +Z.
2. FIXTURE SCREWS GO THRU ITEM 10 AND INTO ITEM 11. 8 PL.

QTY REQD	CAGE CODE	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	FIND NO
1		SXT-2A003	FWD SUPPORT PLATE				11
1		SXT-2A011	RING, OUTER				10
2		AN960C416	WASHER				9
2		LS40515C-4-18	SCREW				8
2		SXT-40062-101	SLEEVE				7
		SXT-40061-101	RING BUSHING				6
8		PICD6-21	WASHER				5
8		SXT-40068-101	SCREW				4
2		SXT-40069-101	BLOCK				3
1		SXT-40066-101	HANDLE				2
-		-101	LIFT FIXTURE				1
-101		PARTS LIST					

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES. TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS. .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG 30 MIN

CONTR NAS8-37334
DCA/CI

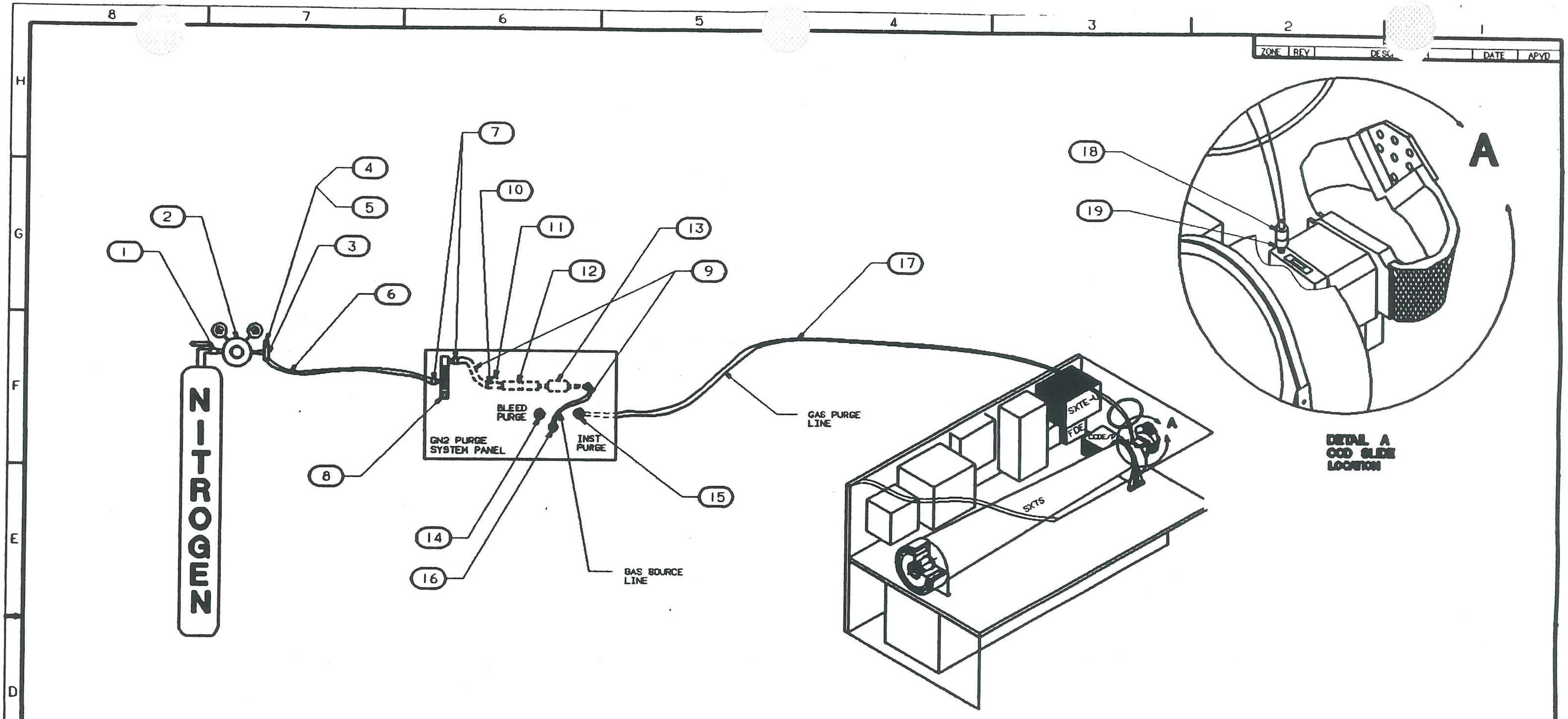
SOLAR-A
NEXT ASSY | USED ON
APPLICATION

DATE 88-11-14
DWN A. THOMAS
APVD J. VIEIRA
APVD M.E. BRUNER
ENGRG B.K. JURCEVICH
CHKR J. VIEIRA
APVD G. GRACWOHL
APVD M. FINCH

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

LIFTING FIXTURE
ASSEMBLY

SIZE E | FSCM 65113 | DRAWING NO SXT-40023 | REV A
SCALE 1/2 NOTED | SH 1 OF 1



EICA

FIGURE 8. 1-3
GN2 PURGE SYSTEM SCHEMATIC

QTY REQD	FSCM	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL DESCRIPTION OR NOTE	MATERIAL SPECIFICATION	ZONE	ITEM NO
1		SS-2-TA-7-2	1/8" MALE ADAPTER	SWAGELOK			19
1		SS-400-1-2	1/8" MALE CONNECTOR	SWAGELOK			18
1			TEFLON TUBING				17
1		SS-QC4-D-2PM	QUICK CONNECT BODY	SWAGELOK			16
1		SS-QC4-D-400	QUICK CONNECT STEM	SWAGELOK	INSTRUMENT PURGE		15
1		SS-QC4-B-400	QUICK CONNECT STEM	SWAGELOK	BLEED PURGE		14
1		6190-T4FF	FILTER	MATHESON	MEMBRANE 0.02 MICRON		13
1		SS-401-PC	PORT CONNECTOR	SWAGELOK			12
1		533T1-1M-1	RELIEF VALVE	CIRCLE SEAL	.5-1.5 CRACK (PSI)		11
1		SS-400-3TTF	FEMALE BRANCH TREE	SWAGELOK			10
2		SS-4BHT-12	FLEXIBLE HOSE	CAJON	12 INCHES		9
1		SERIES 60K	FLOWMETER	LINDE	.05 - 7.0 SLPM		8
2		SS-400-1-2	1/8" MALE CONNECTOR	SWAGELOK			7
1		SS-4BHT-120	FLEXIBLE HOSE	CAJON	120 INCHES		6
1		SS-4CP2-D6-40	PRESSURE RELIEF VALVE	SWAGELOK	25 CRACK (PSI)		5
1		SS-4-TA-7-4	1/4" MALE ADAPTER	SWAGELOK			4
1		SS-400-3TFT	FEMALE BRANCH TREE	SWAGELOK			3
1		TSA-706-320	TWO STAGE REGULATOR	LINDE	3000 PSI/ 80 PSI		2
1		SXT-2M013	METRIC TO CGA CONVERTER	BRASS			1

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIM. ARE IN INCHES TOLERANCES ON:
FRACTIONS = ± 1/16
DECIMALS: .X = ± .03
.XX = ± .010
.XXX = ± .005
ANGLES = ± 0 DEG. 30 MIN
CONTR NAS8-37334

NEXT ASSY | USED ON

DATE 90-08-12
DWN K. GOWEN
APVD M. BRUNER
APVD G. GRADWOHL
ENGRG K. GOWEN
CHKR B. JURCEVICH
APVD S. PATTERSON
APVD

LOCKHEED PALO ALTO RESEARCH LABORATORIES
PALO ALTO, CALIFORNIA

ASSEMBLY-
NITROGEN PURGE
SOLAR-A

SIZE E | FSCM 55113 | DRAWING NO SXT-2M012 | REV -

8.2 SXT Unpacking And Handling Requirements -

8.2.1 Handling Procedure -

The following general considerations shall be observed in handling the SXT hardware:

The shipping containers of the hardware shall be opened for inspection or removal of the hardware only in a clean room environment. To protect against Electrostatic Discharge damaging the SXT, all handling of the hardware shall be done with ground straps being used by the personnel doing the handling.

The following outline procedure shall be followed for SXT handling after arrival at ISAS:

1. The shipping container shall be opened, the Impactograph shall be turned off, and the Impactograph chart shall be preserved.

2. The SXT hardware shall be inspected carefully for identification and possible damage during shipment. The bagging provided for contamination control during shipment may be removed at this time. The integrity of the Thermal blankets shall be examined at this time.

3. The SXTS shall be removed from the shipping container by removing the SXT Instrument Handling Plate from the shipping container with the SXTS attached to it. All horizontal handling of the SXTS shall be done using the SXT Instrument Handling Plate and may be done manually.

4. The SXT Instrument Handling Fixture shall be carefully attached to the SXTS in preparation for vertical attachment of SXTS to the spacecraft.

5. The crane shall be attached to the SXT Instrument Handling Fixture and the SXTS shall be disconnected from the SXT Instrument Handling Plate. The SXTS may then be lifted to a vertical orientation by the crane while the SXTS is maintained in manual control to control dragging.

6. The SXTS may now be moved to the spacecraft and the ISAS procedures for attaching the hardware may be followed.

7. After being secured to the spacecraft the SXT Instrument Handling Fixture may be removed from the SXTS.

8.3 Contamination Control -

8.3.1 Engineering Model -

The only part of the Proto-Model instrument that is susceptible to contamination is the CCD Camera. The type of contamination of concern is particles of dust and dirt. A lesser concern is for moisture contamination. Since we are concerned about electro-static discharge (ESD) possibly damaging the CCD detector, it is not possible to flow dry nitrogen gas past the CCD detector. To flow humidified clean air past the CCD detector would be an acceptable alternative.

Care shall be taken to handle the CCDH assembly with lint-free gloves and cloths or paper towels, at any time it is dismounted from the Filter Wheel Assembly. When the CCDH is mounted to the FWA, care shall be taken to provide a clean environment around the apparatus. The procedure shall be to clean the space where the apparatus is placed before placing it there, and maintain the cleanliness in the environment at all times. If possible, and reasonable, the apparatus should be maintained in a Class 100,000 clean area while under test.

8.3.2 Flight Model -

8.3.2.1 Humidity -

Purge with filtered dry nitrogen or dry air whenever feasible.

The following Operating Procedure is used to connect and operate the GN2 Purge System.

1. Make sure that the CCD Spacer Slide that contains the gas purge fitting is installed in the CCD Spacer which is part of SXTS.

2. Obtain and secure a cylinder of pure, dry nitrogen gas in the vicinity of the SXTS (within 3 meters distance.)

3. Attach the GN2 Gas Purge System to the gas cylinder.

4. First make sure that the low pressure valve of the gas regulator is off, then turn on the gas cylinder valve.

5. Observe that the high pressure gauge reads some pressure (> 200 psi.)

6. First make sure the needle flow valve is off, then turn on the low pressure valve of the gas regulator until the gauge reads 10 psi.

7. First open the needle valve until a flow may occur, then attach the gas supply tube to the gas bleed fixture on the GN2 Purge System Panel.

8. Observe on the flow meter that gas is flowing, and adjust the flow for a setting of 1 liter/minute. Let the gas flow for a minimum of 1 minute.

9. Disconnect the gas supply tube from the gas bleed fixture and attach the gas supply tube to the gas purge fixture.

10. If not already connected, connect the gas delivery tube from the GN2 Purge System Panel to the gas purge fitting on the SXTS at the CCD Spacer.

11. Observe the Flow gauge on the GN2 Purge System Panel and make sure the flow is set to 1 liter/minute. Adjust the needle valve until this flow is achieved.

12. At the beginning and the end of the work day, make sure that enough gas remains in the cylinder to provide for gas purge until the next gas volume

check.

13. When changing gas cylinders, first move the gas supply tube from the gas purge fitting to the gas bleed fitting. Then repeat this procedure after changing the gas cylinder.

8.3.2.2 Organic Outgassing -

Components (e.g., harnesses, structures, adhesives, non-metallic materials etc.) shall be selected for low organic outgassing and shall, when possible, be vacuum baked prior to installation on the FM spacecraft. Avoid organic solvents near the XRMA surface and the CCD Sensor. (The sensor has a window-less package!)

8.3.2.3 Particulates -

SXT shall be delivered clean and will be equipped with 11 micron particulate filters over vent ports. A positive effort shall be made to maintain the cleanliness of the environment around the SXT at all times. Protective covers will be kept in place at much as possible, but cleanliness efforts only work when the environment is maintained as well.

8.4 Spacecraft Integration And Launch Site (KSC) Preparation -

8.4.1 SXT Functional Testing -

8.4.1.1 Test Definition -

The Functional Testing of the SXT after departure from the US shall consists of the following procedure:

A. Select SXTE-U System B using procedure in EICA 9.4
B. Issue ALL PWR OFF command (DC 80H)
C. Perform the following SXTE-U system checkout

1. Verify all SXTE-U relay status OFF
2. * Issue SXT 5V ON command [SXTE-U main +15V & +5V] (DC 82H)
3. Verify proper system is selected
   A: System A is selected (A and E ON)
   B: System B is selected (A and F ON)
4. Wait for at least 4 seconds for Initial Program Load (IPL)
5. Verify IPL complete and SXTE-U uP post reset state (MB Status 4) flags are set and Hard reset checksum flag (MB Error 2) is clear.
6. Perform READBACK test to verify SXTE-U/SXTE-J communications (mailbox)
7. Perform WATCHDOG test to verify SXTE-U microprocessor health
8. * Issue 28V ON command (DC 81H)
9. Verify +28V relay status (B ON)
10. * Issue SHUTTER(Aspect) ON command (DC 85H)
11. Verify Shutter/Aspect relay status (D ON)
12. Verify shutter status (MB Status 1) is OPEN
13. Issue Mechanical shutter mode command (BC 00H 01H) Wait > 100 ms
14. Verify shutter status is closed and shutter mode select (MB Status 1)
15. Issue Frame Transfer shutter mode command (BC 00H 00H) Wait > 100 ms
16. Verify shutter status is open and frame transfer mode select (MB Status 1)
17. Issue Aspect Door Close command (BC 04H 00H) - Wait > .5 second
18. Verify Aspect Door status (MB Status 1 / MB Status 4 / Error 1)
19. Issue Aspect Door Open command (BC 04H 00H) - Wait > .5 second
20. Verify Aspect Door status (MB Status 1 / Status 4 / Error 1)
21. * Issue CAMERA ON command (DC 83H)
22. Verify camera relay status (G ON)
23. Issue full frame flush command (BC 01H 01H)
24. Verify setup complete flag (MB Status 2) and LS1 and Frame Gate error flags (MB Error 2) are clear
25. * Issue FILTER ON command (DC 84H)
26. Verify filter relay status (C ON)
27. Issue SXTE-U microprocessor DAY command (BC 02H 01H) - Wait > .5 second
28. Verify filter wheel A and B positions (MB Status 02)
29. Verify microprocessor initialization per Section 5.3.6.2
30. Verify filter wheel A function for all positions (BC 03H 0XH, X=1,6)
31. Verify filter wheel B function for all positions (BC 03H X0H, X=1,6)
32. Position filter for exposure tests - aft filter open, forward filter optical diffuser (BC 03H 14H)
33. Apply current through CCD IRED stimulus (20 ma)

34. Set SXTE-J register for default SXTE-U image (2x2 full frame)
35. Issue start Dark Frame exposure command (BC 0FH 02H)
36. Verify all mailbox status as expected and MB Error 1 and 2 are clear
37. Dump SXTE-J image buffers and verify camera data (BLS, Row numbers, image)
38. Issue start Normal exposure command (BC 0FH 01H)
39. Dump SXTE-J image buffers and verify image data
40. If required, adjust exposure level to obtain properly exposed image (BC 0EH XXH) and repeat steps 35 and 36.
[41.] [Note: TEC ON may or may not be exercised during Functional Checkout, but TEC checkout procedures shall be followed.]
42. Execute Day to Night transition per EICA 9.2
43. Verify peripheral status in photon flood configuration per 5.3.10

* monitor +5V and +28V bus current during all power commands

D. Select SXTE-U System A using procedure in EICA 9.4
E. Repeat SXTE-U steps B. and C.(1.-43.) for system A
F. Continue operating as required for other testing.
G. Issue ALL PWR OFF command (DC 80H)

8.4.1.2 Data Requirements -

With the normal telemetry stream connected, observe the Housekeeping, the "basic" part of the data, and the image data for proper instrument functionality.

8.4.2 Remove-before-flight (Red Tag) Protective Covers -

- o CCD protective slide -- requires access to SXT focal plane area.
- o SXT telescope cover -- requires access to front of telescope.

CHAPTER 9

PROCEDURE FOR POWER CONTROL

9.1 SXTE-U Post Launch Initial Power-up And Checkout -

1. Verify all SXTE-U relay status OFF
2. Issue SXT 5V ON command [SXTE-U main +15V & +5V] (DC 82H)
3. Verify System A is selected (A and E ON)
4. Wait for at least 4 seconds for Initial Program Load (IPL)
5. Verify IPL complete and SXTE-U uP post reset state (MB Status 4) flags are set and Hard reset checksum flag (MB Error 2) is clear.
6. Perform READBACK test to verify SXTE-U/SXTE-J communications (mailbox)
7. Perform WATCHDOG test to verify SXTE-U microprocessor health
8. Issue 28V ON command (DC 81H)
9. Verify +28V relay status (B ON)
10. Issue SHUTTER(Aspect) ON command (DC 85H)
11. Verify Shutter/Aspect relay status (D ON)
12. Verify shutter status (MB Status 1) is OPEN
13. Issue Mechanical shutter mode command (BC 00H 01H)
14. Verify shutter status is closed and shutter mode select (MB Status 1)
15. Issue Frame Transfer shutter mode command (BC 00H 00H)
16. Verify shutter status is open and frame transfer mode select (MB Status 1)
17. Issue CAMERA ON command (DC 83H)
18. Verify camera relay status (G ON)
19. Issue full frame flush command (BC 01H 01H)
20. Verify setup complete flag (MB Status 2) and LS1 and Frame Gate error flags (MB Error 2) are clear
21. Issue FILTER ON command (DC 84H)
22. Verify filter relay status (C ON)
23. Issue SXTE-U microprocessor DAY command (BC 02H 01H)
24. Verify filter wheel A and B positions (MB Status 02)
25. Verify Aspect Sensor Door is open (MB Status 1 and Status 4)
26. Verify microprocessor initialization per Section 5.3.6.2
27. Issue Mechanical shutter mode command (BC 00H 01H) [Cover CCD]
28. Verify filter wheel A function for all postions (BC 03H 0XH, X=1,6)
29. Verify filter wheel B function for all positions (BC 03H X0H, X=1,6)
30. Position filter for optical imaging - aft filter open, forward filter wide band filter (BC 03H 15H)
31. Set SXTE-J register for default SXTE-U image (2x2 full frame)
32. Issue manual dark frame exposure command (BC 0FH 02H)
33. Verify all mailbox status as expected and MB Error 1 and 2 are clear
34. Dump SXTE-J image buffers and verify camera data

(BLS, Row numbers, image)
35. [Assumes Solar-A orbital day KSC contact]
Issue manual normal frame exposure command (BC 0FH 01H)
36. Dump SXTE-J image buffers and verify image data
37. If required, adjust exposure level to obtain desired image (BC 0EH XXH) and repeat steps 35 and 36.
38. SXTE-U system is ready for operations

9.2 Procedure For Day To Night Transitions -

The following actions are used for switching SXTE-U to Night mode:

1. Issue mailbox NIGHT mode command (BC 02H 00H)
2. Wait a minimum of 8 seconds for completion of SXTE-U night activities
3. Issue SHUTTER(Aspect) OFF command (DC 8AH)
4. Issue FILTER OFF command (DC 8BH)
5. Issue CAMERA OFF command (DC 8CH)

The timing between day/night mailbox command and CMACTs is:

```
           D->N                                     N->D
           ---                                      ---
Mailbox     | |                                     | |
(J->U)  ---- -----------------------#----------------  -------------
           |<-->|
          min 8 sec
                 ---  ---  ---           ---  ---
                  | |  | |  | |           | |  | |
CMACT------------- ---- --#- ------#----- --#- --------------------
                |<-->|                        |<--->|
                min 200 msec                  min 200 msec

SXTE-U        |<---------------no command write--------------->|
mailbox*******----------------------#-------------------------*****
command         (Status read will be made even during
                 night time.)                         |<--->|
                                                        min 8 sec
```

9.3 Procedure For Night To Day Transition -

The following actions are used for switching SXTE-U to Day mode:

1. Issue CAMERA ON command (DC 83H)
2. Issue FILTER ON command (DC 84H)
3. Issue SHUTTER(Aspect) ON command (DC 85H)
4. Wait a minimum of 200 milliseconds
4. Issue mailbox DAY Mode (BC 02H 01H)
5. System is ready for operation.

9.4 Procedure For Switching Processors -

The following actions will be used for switching SXTE-U microprocessor systems:

1. Issue ALL PWR OFF command (DC 80H).
2. Verify all bilevel status is OFF (A,B,C,D,E,F,G,H=0)
3. Issue SXT 5V ON [Main +5V/+15V] (DC 82H).
4. Select appropriate System:
   A: a. Issue SELECT SYS A (DC 87H)
      b. Verify Status A & E = ON.

   B: a. Issue SELECT SYS B (DC 88H)
      b. Verify Status A & F = ON.
5. Continue Procedure 9.1 - Initial Power Up - at Step 4.

9.5 Procedure For EMERGENCY SHUT DOWN -

The following SXTE-J action will be used for EMERGENCY SHUT DOWN of the the SXT-U system.

1. Issue ALL PWR OFF (DC 80H)

This page is to insure that the next chapter starts on an odd page.****

CHAPTER 10

POST-LAUNCH OPERATION

10.1 Check-out And Turn-on -

10.1.1 Initial Turn-on Sequence -

See EICA Section 9.1.

10.1.2 Functional Verification -

See EICA Section 8.4.1.

10.1.3 TEC Start -

Before turning on the TEC, sufficient delay must be allowed to ensure for sufficient outgassing of the SXTS instrument and SOLAR-A spacecraft. This is to avoid it becoming a thermal "sink" for volatile materials. This time will be determined after the launch and should be a minimum of two weeks.

10.1.4 Use Of Redundant System -

It is intended to start operation of the SXT using System A. Operation of SXT will continue using System A until such time as it becomes necessary to switch over to System B. There is no intention to check out System B until it becomes necessary to use System B.

10.1.5 Use Of Aspect Sensor Door -

Since the concept of the SXT design is to not use the Aspect Sensor Door unless it is decided that it is necessary for proper imaging, the Aspect Sensor Door will initially be commanded open and no further commands will be given until it is decided that other commanding is required. The initial command is to ensure the Door is open after the launch.

10.2 Normal Scientific Operation -

10.2.1 Science Observing Planning -

See the SXT Science Operation Plan document.

CHAPTER 11

CONTAMINATION CONTROL

11.1 Ferromagnetic Materials -

The materials that are included in this sections are: co, invar, etc.

Table 11.1-1
Ferromagnetic Materials

Manufacturer	Amount Used	Purpose
1. Invar/Super Invar		Mirror Contact Pad
2.		

11.2 Nonmetallic Materials -

The nonmetallic materials used in the SXT are listed in the following table.

SXT NON METALS MATERIAL LIST

	Non Metals	Specification	USE	Type
1.	Lexan 1800 A	(Polycarbonate?)	Filter Material	A
2.	Teflon		Witness Mirror Bushing	
	A. Sleeving ST10033	MIL-I-22129	Non Flight	A
	B. Teflon Tubing PTFE	MIL-I-22129	Material code 62820	A
	MIL-I-22129 = pure Teflon			
3.	Fiberite/P75	Amoco	Metering Tube (MT)	A
4.	Fiberite/AS4	Hercules	Metering Tube (MT)	A
4a.	Fiberite 934 Epoxy Laminate		Prepreg for MT2	A
4b.	Lockheed SRBF-1 Si type material		Prepreg for MT3	A
4c.	See 5D			
5.	Epoxy			
	A. Shell Epon 828	100 pts/wt	Filter Material	A
	Henkel Versamid 125	100 pts/wt	cure 24 hr - RT	
	JSC 08962 TWL=0.79% VCM=0.01%		cure 7 days - 25C	A
	Epikote 828/versamide 125		Cure 24h - 65C	

Pinhole Plugging Cement

Acme E-Solder 3022 125 pts/wt 8 mgm C
Acme Hardener 18 10 pts/wt cure 24 hr - RT
E-Solder 3022 Contains:
Silver, Epoxy Resin and 1,4 Butanediol Diglycidyl Ether

Hardener 18 contains:
Polyethylene polyamine and Polyglycol Diamine
Recommended by Huston control manual
According to Nasa ref. pub. 1124 for cure 1.5 Hr - 85C
TWL=1.27% VCM=0.02%

Hexcell Epolite 2409 Epoxy 100 pts/wt U
*(Resin Formulators RF 130 Black 5 pts/wt)
Hexcell Epolite 2180 Amine 22 pts/wt cure 24 hr - RT

According to Dick Goddard from Harward college observatory, this material was used on Rosat program. On Rosat program this Hexcel Epolite 2409 was covered with Epoteck (Epoxy Technology) 410 LV. Goddard space flight center approved the use of this material for outgassing.

Hexcel Epolite 2409 used to be called APCO 210.
APCO = Applied Plastic CO of El Secundo Calif.
Before, the name of this material used to be 5290.
However the 5290 had a different diluent, the reactive modifier was slightly modified.

Hexcel Epolite 2180 (Copolimer Amin Resin) used to be called APCO 180.

Epon 828/Versimid 140 Cure 12h - 50C plus 24h - 125C B

B. EM EC 2216 BA Type1 Mirror, Invar to Zerodure A
Amber = not filled with filler
Gray = filled
3M Mcode=05066 Cure 24h-46F/24h-203F (DN 8)
Nasa handbook 127 TWL=0.73% VCM=0.04%
With cure of 7 days - RT A
With cure of 3 days - RT (from J. Vieira) A

C. Prepreg 3501-6 Metering Tube (Not used) U
D. Hysol EA934 NA Metering Tube to Titanium A
E. HYE 2034 graphite epoxy prepreg " " A
F. HYE 3034 graphite epoxy prepreg " " A
G. AF163-2M Film Adhesive " " C
3M. this is used between the Al foil and the Tube
AF163-2M was formerly designated as AF55 Cure 1Hr - 177C
TWL=0.81% VCM=0.17%

LPARL Misc 6-11

6. Epon 828/Versmid 140 Component Staking, filter material B
Cure 12h at 50C plus 24h at 125C

7. Scotchweld 1838 A/B, 3M Component Staking C

Nasa ref. doc. 1124 TWL=0.65% VCM=0.03% Cure 24 Hrs at RT then
25 min at 250F
Not used on FM
----

8. Uralane 5753A/B (LV) LAC 40-4646B Component Staking A
Used in SXTE-U and Aspect Door
Furane
Cure 4hr-RT + 9hr-150F
mcode 20207
MSFC handbook 527
----

9. Uralane 5750A/B LAC 40-4647A Conformal Coating A
MIL-I-46058C
Used in SXTE-U and Aspect Door
Urethane Uralane 5750A/B Cure 4hr - Room T + 9h - 65C (150F)

Both Uralane materials 5750 A/B and 5753 A/B are A type
according to JSC SP-R-0022 per ASTME 595.
Information received from Bill Hansen Tel:27768
According to Bill Hansen CAB-O-SIL M5 does not change the A rating.

10. Cabot CAB-O-SIL M5 LAC 42-4421C Thickener (RC) U
EPS 42-221
Used in SXTE-U and Aspect Door
CAB-O-SIL gets the ratings of the materials it is mixed with.

11. Stycast 2850/11 Cure 16Hr -167F/4Hr -300F
Emerson & cuming Mcode=62319 TML=0.51 VCM=0.05 B
Used on Aspect Subs.
Cure data in DN8 Cure 16Hr -180F/4Hr -300F

12. Zerodure (Gold coated) Mirror A

13. Fused Silica Aspect Sensor Optics A

21. Circuit Board Material
Plastic sheet laminated
Metal clad MIL-P-13949/10 Type GIN
Mcode = 80301 Polyimide, natural color Resin
Used in SXTE-U and Aspect Door
A if using EPS Materials, tested by Starlab A
Board is conformal coated with Uralane 5750A/B.
We need to find out from whom they buy the prepreg material.
We also need the cure information.

Circuit Board Material MIL-P-13949/12 Type PC-GF-008 A
manuf. Sigma Circuits, Costa Mesa

We need to find out from whom they buy the prepreg material.
We also need the cure information.
Prepreg manuf. Polyclad
All boards are conformal coated with
Uralane 5750A/B. See 9.
Solder coat per NHB 5300.4 (3A)

22. Circuit Board Material MIL-P-13949/4 Type GFN-031-C1/C1-B1B A
" " MIL-P-13949/4 Type GFN-094-C1/C1-B1B
Backing Board MIL-P-13949/4 Type GFN-008-00/00-B1B

Epoxy glass Laminate MIL-P-13949/4 Type GFN-008-C1/C1-B1B
Printed Wiring Board MIL-P-55110
Insulating Board 0.008" MIL-P-18177 Type GEB A
Terminal Board 0.094" MIL-P-18177 Type GEE Nema Grade FR-4 A
MIL-P-18177 Type GEE Glass Fiber Laminate A (RC)

23\. Flux solder Type RMA MIL-F-14256D(2) (RC)
Solder Type W-RMA-P(2) SN63 Per QQ-S-571E(2) (RC)

24\. Wire, hook-up MIL-W 22759/18-9-20 Bay Assos. A (RC)

24a.TECKNIT,TECKSPAN Al & Si rubber per ZZ-R-765 class 2b (RC)
Gasket cover .032 sheet Grade 50 color Gray
EMI shielding Mark part # per LAC 3575-011998
Part # 48-09866 TWL=0.92 or 0.45 VCM=0.20 (1124)
FSCM 07700 Part # 48-09866,
TWL=0.92 or 0.45 VCM=0.20 (1124) Bake 24Hr -100C C
Material Engineer at manufacturer recommends:
Bake 24Hr -125C
Preferrably in vacuum (10E-5 PSI?)
The higher temperature or vacuum or both are supposed to reduce the VCM.

24b.Cards guide for SXTE-U.
Mold per LAC 3209-012320.
Using material LAC 40-4299-0100.
Mark part # per LAC 3575-011998.
Protect & handle per LAC 1001. TML=0.51 VCM=0.06
3M Scothcast 280. Mcode = 20148 cure 24Hr -150F B

25\. Dupont SP22 Vespel Thermal Insulator FDE, SXTE-U, CCDE/P A

26\. Connector D Type GSFC-S-311-P-409 S (RC)

VAC bake per MSFC-Spec-548
It requires 48 hrs bake at 350 F at 1E-6 Tor vacuum.
2 in FW, 1 in SM, 3 in CU.
Brass gold plated. stress corrosion is the problem.
No or low tensile stress. No atmosphere in space.

27\. Connectors
a. LMSC DWG # 1621437 IEH A (RC)
IEH=Indastrial Electronics Hardware Co.
JSC-SP-R-0022 MIL-M-14, ASTM A582, ASTM -E-595
b. LMSC DWG # 1621438 IEH A (RC)
JSC-SP-R-0022 MIL-M-14, ASTM A582, ASTM -E-595

c. Winchester JF2S2S, JF2S Diallilphalate per MIL-M-14 SDG-F DAP A
d. Winchester JF2P2P, JF2P Diallilphalate per MIL-M-14 SDG-F DAP A

e. Connector, Airborn M series MR-261-037-435-220S,
Non polarization per MIL-C-83513 A
Molded insulators.
Glass filled Poly Phenylene sulfide per MIL-M-24519.
Insulating compound per MIL-I-16923
Face seal gasket Silicone rubber per ZZ-R-765
Seal gasket not used

Fluorosilicone per MIL-R-25988

29. Tubing
    A. Sleeving Teflon ST10033, MIL-I-22129 (Non flight) A
    B. Tubing Teflon PTFE MIL-I-22129 Mat. code 62820 A
    C. Tubing Teflon, Extruded 108242-5 Sonic Wire Sale A
    D. Shrinkable tubing ST10017 Polyvinylidene Fluoride (PVF2),
    Kynar. Mcode = 06090 A

30. Thread, polyester V-T-285, Type1, Class 1, Subclass A
    Hemingway Bartlett, Size E, CLR White LMSC 25-204-0010834
    V-T-285(D) A
    Thread Dacron "E" VT-285

31. Transfer film, Acrylic Adhesive 1 in. wide.
    PN 966, 3M Co, LMSC 24-221-0101830 LAC 24-4465B
    EPS 24-221 A

32. Transfer film, Acrylic Adhesive 2 in. wide.
    PN 966, 3M Co, LMSC 24-221-0201830 LAC 24-4465B
    EPS 24-221 A
    PN 966 is the adhesive part number for the adhesive for all the tapes. This adhesive absorbs water, and after aging on the ground it bubles when heated above 250F. Once it is in space it lasts a long time, because there is no moisture there.

32a. Tape scotch Y-966 Transfer film Acrylic/Foil sandwich
    (1124) TML=1.02 VCM=.01
    Y-966 and 966 are the same product. The "Y" indicates it is experimental/special material and is dropped when it becomes a standard product.

33. Aluminized Mylar (Dam) 0.00025TK Al Both sides MLI
    King seely metal products Co, LMSC 22-344-0510532, LAC 22-4402C
    EPS 22-344 A

34. Tape
    D. Tape, Aluminum Foil RFI tape, Conductive Adhesive 892-L.
    Lamart Co.
    Report # GSC 12700
    Nasa Ref. Pub. 1124 TWL=0.21%, VCM=0.01% A
    This tape when used it is taped over with Al Kapton tape.

    E. Tape Polyimide, acrylic adhesive 2342-1R
    Oak materials, Groud, Hoosick Falls NY.
    LMSC 24-222-0100587? LAC 24-4450E
    EPS 24-222 A
    According to Marshall VCM on this material is too high.
    VCM=0.44%
    TWL=.25% VCM=.01% from Lockheed test report.

    F. Fastener tape Hooks 1 in. wide
    MIL-F-21840F Type II, Class 3 (23H)
    Velcro Corp. LMSC 26-900-0102251, LAC 26-4841?
    Class 3 = Polyesther EPS 26-900 A

    Marshall's comment on Tapes 39 F,G is that polyester has a high rate of outgassing.

G. Fastener tape, Pile, Polyester 1 in. wide
MIL-F-21840F Class 3, Velcro Co
LMSC 26-900-0102200 LAC 26-4841
EPS 26-900 A

H. Acrylic Kapton V.D. Al Scotch 3M
V.D. = vapor depositted
Hi temp Acrylic Used with MLI
2 specs. This one has Al outside.
Bake the Kapton tape on the Thermal blanket
for 24h - 93C.
Tape Aluminized Polyimide, Acrylic Adhesive
1 in. wide, PN G401000 Shedahl
LMSC 24-304-0010319, LAC 24-4498D
EPS 24-304 A

I. Tape Aluminized Polyimide, Acrylic Adhesive
3 in. wide,
LMSC 24-304-0030837, LAC 24-4498D
EPS 24-304 A

J. Acrylic glue, fiberglass cloth,
Kapton, V.D. (vapour depositted) Al,
Hi temp Acrylic used with MLI, Scotch 3M
2 specs. This one has Al outside. LAC 24-4687
EPS 24-232 A

K. Tape, Fiberglass, Acrylic adhesive 1/2 in. wide
white P-213, Permacel Co.
LMSC 24-312-0038035 LAC 24-4655B
EPS 24-312 A
According to Marshall VCM=.14. Too high
Lockheed test reports showing it is type A were sent
to J. Owens at Marshall.

L. Glass Fiber cloth/ Aluminum, G127200 class 2000
LMSC 22-343-1236842 LAC 22-4448D
EPS 22-343 A

M. Glass Fiber Aluminum Tape, Acrilic adhesive
Sheldahl Co.
LMSC 24-232-0100397 LAC 24-4687B
EPS 24-232 A
LMSC number is a special order

N. Tape for Thermal test
Double sided Milar, acrylic adhesive Mcode =20891
Scotch 3M #415

	TML	VCM	
	.77	.07	
(1124)	.91	.01	A
JSC 08962	.91	.01	A

Accordinng to Marshall this material is rated C in MSFC
handbook 527.

O. Tape Scotch Y-9460 Isotac Acrylic Transfer film Mil/F
LAC 24-4693-0002

(1124) TML=.85 VCM=0 Transfer tape. Mcode 61019 3M
(527F) TML=.85 VCM=.01 A

PN 9460 is LMSC 24-216 2000028 TML<2% VCM<0.1% not used

P. Tape Scotch Y-9469 Isotac Acrylic Transfer film 5 Mil/F
LAC 24-4693-0005
(1124) TML=1.29 VCM=.02 Transfer tape. Mcode 60596 3M
(527F) TML=1.29 VCM=.02 A

35. Epibond 1210A Resin 9615-10 Hardener, Color Blue B
Furane Products Co., Cage 99384
Cage # = FSCM # = Federal supplier number. SPEC #OS9330A(2)
Mix formula: 100pts 1210A 50pts 9615-10 by weight
Cure: 48 hrs - room temp (RT)
Expected Env: -130C/50C 1E-6 Torr
Reason for selection: Low Temp. properties
This material is now tested at GSFC for PEM/UARS.

35a. Epibond 1210 with 9615-A (100 to 65 pts/wt) B
LAC 30-4639-0100 MCODE=60354
Process spec LAC 3210-xxxxxx
Cure 2Hr -150F or 48 Hr -RT

CURE (Maptis) 48 HR -46F?
TWL=0.66% VCM=0.02%

36. RTV
A. RTV 566 GE .07-.7 CAT MCODE 03484 cure 2 HR -140F B
Nasa Ref Pub. 1124 cure 7 Days -25C A

B. RTV 567 GE .5% CAT " 05410 cure 120 HR -70F A
Expensive. Nasa Ref Pub. 1124. cure 5 Days -25C A

C. Rubber Silicone RTV 162 GE MIL-A-46106 A, Mcode=05185
(1124) TML=1.59 VCM=.42 cure 7D -25C
(527F) TML=1.53 VCM=.36 cure 168Hr-70F- C
24Hr-150F-

D. RTV AL Oxide filled
Thermally conducting, electrically insulating
For Thermal Strap Assembly.
Cotherm -might be used instead (spongy)
Not used

E. 40-4730 Mcghan Nusil cv 2943
Thermally conductive Silicone LAC 40-4730-0200 A
TWL<1%, VCM<.1%
Marshall's comment:
What did come off was bad for X-ray.
I sent Marshall a test report on this material.

Ea. Delta Bond 152A Waikfield Eng. LAC 30-4371
Thermally conductive, electrical insulator.

F. Alcohol based, room temp.RTV Dow Corning DC 3140 Mcode 05163.
Used for mounting filters.

TML=2.18 VCM= 0.49 C
Used by T. Cruz for EM Entrance filters on Aspect subsystem.
Not used on FM.

G. Use for FM Aspect sensor DC 6-1104 Mcode 05227
TML=.16 VCM=.08. Cure 24Hr -RT + 24 Hr - 150F B
The following information is from D. Ezell
TML=.15 VCM=.02 with cure of 24Hr -46F plus 24 Hr - 150F B
or with the following alternate cure 7 days at room temp.

H. Use for FM Aspect sensor Rubber silicone DC 93-500
Al Oxide fill
Potting compound Mcode 61846 A
MSFC handbook 527F TML=.11 VCM=0 cure 24Hr -392F-
168Hr -46F-
4Hr -140F-

I. Insulation material in the CCD spacer:
Delrin Du Pont Co. A
Resin --- polyoxymethylene Mcode=65155
better known as "Acetal Homopolymer" No cure needed
A crystalline polymer of formaldehyde
comercialized in 1960 by Do Pont Co

49. Chemglaze black Poly-Urethane coating,
Paint for surfaces of Electronics Boxes
Z306, Lord Corp. EPS 37-494 LAC37-4462-0100 C
TML=1.81%
CURE 24h - 65C
Mcode 06173 MSFC handbook 527 CURE 7 days at RT B
Mcode 06173 MSFC handbook 527F TML=.91% VCM=.00% B
with cure of 24Hr -70F
plus 168 Hr -70F
plus 24 Hr -150F
Chemglaze Primer 9924, Lord Corp. LAC37-4467 B
EPS 37-276
Chemglaze Primer 9922, Lord Corp. B
Mcode 65540 MSFC handbook 527F TML=1.55% VCM=.02% B
RML=.45%
with cure of 16Hr -46F
plus 16Hr -140F

LAC 3803-050132 is the process specification for applying organic finishes.
The coating consists of the Chemglaze 9922 primer, using the cure in MSFC handbook 527F.
Then painting with polyurethane Flat black paint Chemglaze Z306, using the cure specified in MSFC handbook 527F.
B
This paint is used on the electronics boxes and on the inside of the Aspect sensor.

50. Polyimide, 0.00025 in. Aluminized both sides MLI
Aluminum Kapton embossed, King seely metal products co.
LMSC 22-348-0045551 LAC 22-4413F A
EPS 22-348

A. Teflon FEP Sheet .010TK Dupont

LMSC 22-304-0050154	LAC 22-4125B EPS 22-304	A
B. Teflon TFE Rod 0.032 diam. Ams 3651 Dupont	EPS 22-303	A
51. Velcro, class=3, (polyester) Type II Holds insulation unto SXTS	MIL-F-21840G EPS 26-900	A

48. Chemicals:
A. Trichloroethane 1:1:1 Inhibited
B. Alcohol, Ethil, 100%
These materials evaporate so it is not a problem in space. Mention in cleaning procedure, to wipe out with dry cloth in a well ventilated area.

SMI control unit
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52. Tape, lacing, white P/N 108791	Glass yarn, PTFE coated	Dodge Fluorglas Div Oak materials group Also Oak industries or Oak Nortlex P/N 779-1075	A
53. Solithane 113-C300 P/N 111901	Cushion, Board-Edge	Morton Thiokol	A
54. Primer, 2-Part Epoxy	Chemglaze 9922 LAC37-4467	Lord Corp. Hughson Chemical	B
55. Paint, Polyurethane	Chemglaze Z306 LAC37-4462-0100	Lord Corp. Hughson Chemical TML=1.81% Cure 24h at 65C See item 49.	B
56. Tubing, Extruded, teflon P/N 108242-5	Thin wall tubing AMS 3655	Sonic wire sale Temp rating 250 C	A
57. Solder	W-RMA-P3 SN 63 SPS 78, QQ-S-571		

Following four materials are mixed together and covered w/ uralane 5750 A/B

Cure time = for Type II Materials 150F+/-5F for at least 6 hr
2 Hrs when Type I is used immediately.
Then apply Type I material and cure at 150F+/-5F for at least 9 hours.

14. CAB-O-SIL M-5	SPS 71 Type II MIL-S-47129	Filler, Cabot corp.	U
15. Calcofluor RWP American Cyanamid company	SPS 71 Type II	Flourescent Indicator	U

17. Thermolite 12 Chemicals Group, Air Prod & Chem Inc	SPS 71 Type II	Catalyst	U
18. Solithane 113/C113-300 Thiokol Chemical Corp Urethane Solithane 113,113-300	SPS 71 Type II	Coating Cure 504h at 70F Cure 21days at room temp	A
19. Uralane 5750 A/B	SPS 71 Type I Furane	Coating Cure 9h at 150F (65C)	B
20. EC-2216-B/A Gray	SPS 74, 3M	Adhesive	A
21. Circuit Board Material A. Copper Clad Laminate B Stage Prepreg	MIL-P-13949/12, Type GF MIL-C-55636 manuf. Sigma Circuits, Costa Mesa Prepreg manuf. Polyclad All boards are conformal coated with Uralane 5750A/B Solder coat per NHB 5300.4 (3A)		A
B. Solder Plate	MIL-STD-275		
C. Ink, Silkscreen Hysol M Series:	MIL-I-43553		
White Epoxy Ink for marking M-9-N Mcode 00030 TWL=4.91% VCM=0.00%		cure 3 hr - 130 F	U
Black Inorganic Epoxy Ink M-0-NC Mcode 05726 TWL=6.51% VCM=0.07%		cure 3 hr - 130 F	U

Find out from SMI and RC if these are the cures that we use.
All boards are conformal coated with Uralane 5750A/B.
Cables and boxes will need to be conformal coated with Uralane 5750A/B by LPARL.

SHUTTER MOTOR

58. Bearing Ball Linen Base Phenolic P/N 110752,110757 Mcode=60075 TWL=3.07% VCM=0.01%	CRES 440C, QQ-S-763 impregnated with Brayco 815Z oil MIL-P-79, TYPE FBE KEENE Corp. KAYDON Bearing Div. Catalog #300	Tends to absorb water	U
59. Tape, lacing P/N 108917	Glass yarn PTFEW coated	Dodge Fluorglas Div Oak materials group also Oak industries or Oak Nortlex P/N 779-680	A

This tape replaced the following tape:
Nomex lacing tape Mil-T-43435, Type 5 Uncoated Nomex U
color natura P/N 104257 Western Filament Co
P/N 20H0F9X

Tends to absorb water

NOT USED!!

Not used in Shutter Motor only used in Filter wheel.

60.	Sleeving, heat shrink P/N 102128-14,15,16	Irradiated Polyefin AMS-3636	RNF-100 TYPE 1 RAYCHEM Corp.	A
61.	Adhesive, EPON 828 100pts/wt	SPS 43	Shell Chemical Co.	B
62.	Activator, EM-308 50pts/wt +/-10%	SPS 43	Thiokol Chemical Co. Cure 140-155F for 3 hr min.	B
	JSC 08962 TWL=0.77% VCM=0.06%		Cure 48Hr -25C	A
63.	Adhesive, LCA-4	SPS 31	Bacon Industries	A
64.	Activator, BA-5	SPS 31	Bacon Industries	A
	LCA9/BA5 (we don't use that)		Cure 2h - 93C	
65.	Solder	W-RMA-P3 SN 60 SPS 39 QQ-S-571	Kester Solder Co.	
66.	Brayco Micronic 815Z Oil		Bray Oil Co.	A
67.	Copper Clad Laminate Sheet Copper Clad Laminate B Stage Prepreg	MIL-P-13949/4, Type GFN MIL-P-13949/12, Type GF MIL-C-55636 manuf. Sigma Circuits, Costa Mesa Prepreg manuf. Polyclad All boards are conformal coated with Uralane 5750A/B Solder coat per NHB 5300.4 (3A)		A A
68.	Connector	311409-3P-B-12, 25P, D Type, NON-MAG Brass per QQ-B 626 (Shell) Diallyl Phthlate MIL-M-14 Type SDG-F (insulator) Copper Alloy Contacts Gold per MIL-G-45204 Type II, GR.C, CL.1 Over Copper MIL-C-14550	Shell & Pins	A

FILTER WHEEL ASSEMBLY

58.	Bearing Ball Linen Base Phenolic P/N 110752,110757	CRES 440C, QQ-S-763 Keene Corp. Kaydon Bearing Div. Catalog #300 MIL-P-79, TYPE FBE Tends to absorb water		U
77.	Board, circuit MIL-P-55110 Type 3	Coper clad laminated sheet Type GEE MIL-P-13949/4 Type GFN MIL-P-13949/12 manuf. Sigma Circuits, Costa Mesa Prepreg manuf. Polyclad		A

	All boards are conformal coated with Uralane 5750A/B Solder coat per NHB 5300.4 (3A)		
78. Board ,Terminal P/N 111170-1	Epoxyglass G-10, Type GEE, MIL-P 18177		A
65. Solder	W-RMA-P3 SN 60 SPS 39 QQ-S-571	Kester Solder Co.	
68. Connector	311409-3P-B-12, 25P, D Type, NON-MAG Brass per QQ-B 626 (Shell) Diallyl Phthlate MIL-M-14 Type SDG-F (insulator) Copper Alloy Contacts Gold per MIL-G-45204 Type II, GR.C, CL.1 Over Copper MIL-C-14550	Shell & Pins	A
66. Brayco Micronic 815Z Oil		Bray Oil Co.	A
69. Brayco 601 grease		Bray Oil Co.	A
60. Sleeving, heat shrink P/N 102128-14	Irradiated Polyefin AMS-3636	RNF-100 TYPE 1 RAYCHEM Corp.	A
70. Tubing, Extruded, teflon P/N 102842-3	AMS 3655		A
71. Wire, Lead	Per M22759		A
P/N M22759/18-24-0,1,2,3,4,5			
P/N M22759/18-26-0,1	Per M22759		
P/N M22759/18-26-90,91,92,93	Per M22759		
72. Magnet	Proprietary		
74. Wedge, rotor P/N 111167	Epoxyglass sheet G-10 Type GEE MIL-P-18177		A
79. Plate ID, black anodized 0.005 Al	MIL-P-19834 adhesive 3M #467		A
61. Adhesive, EPON 828 100pts/wt	SPS 43	Shell Chemical	B
62. Activator, EM-308 50pts/wt +/-10%	SPS 43	Thiokol Chemical cure 140 to 155F for 3 hr min	B
	JSC 08962	Cure 48Hr -25C	A
63. Adhesive, LCA-4	SPS 31	Bacon Industries	A
64. Activator, BA-5	SPS 31	Bacon Industries	A

* note: Totally encapsulated in Y-210 and wash coat with EPON 828/EM308

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75. Stick, top P/N 100148-45	COTTON BASE PHENOLIC	U*

		MIL-P-15035, Type FBE, GR.LE (FBM) M=mechanical specs	Tends to absorb water	
76.	Tape Insulation P/N 109960	Acrylic Mylar MIL-T-15126 Type MFT-2.5	P/N P280 Permacel Corp.	C*
59.	Tape, lacing, P/N 104257 Western Filament Co. P/N 20H0F9X, Mat. code? 06061	MIL-T-43435, TYPE 5	Uncoated Nomex	U*
73.	Magnet Wire Type M2 P/N HML-33-AWG	J-W-1177, Class 220	NWS Precission wire Hudson Wire Co.	C*
80.	Epoxy Powder	E301 Green, SPS 1	Armstrong Products	U*
81.	Adhesive, Bondmaster E645	Part I & II (SPS 2) TML=0.81% VCM=0.24%	National starch and chemical Co. Cure 14 Hrs -266F	C*
82.	Insulation, Thermodur Y-210 Polyester Resin, phenolic modified Nasa Reference Publication	(SPS 30) Sterling Varnish Div. reichhold chemicals #1014 1978 #1124 1984	cure in data sheet 4-6 hrs -135C or 2-4 hrs -150C in SMI process spec cure 20-28 hrs -149C	U*
	JSC 08962 says it is Type A with the following	TWL=0.56% VCM=0.07%	cure: Cure 20 hr -149C plus 24 hr -125C in Vacuum.	A*

* note: Totally encapsulated in Y-210 and wash coat with EPON 828/EM308.
Y-210 is in the Goddard data base.

OPTICAL FILTER MATERIALS

Focal Plane Filters

Material	use	dimensions	notes
BK7-G18 glass Schott	substrate	2.5 mm thick, 1.45" diameter	2 pieces per filter
Schott UG-5, glass	attenuator	approx. 2 mm thick, 1.45" diam.	zero exposed surface area.
Zinc Sulfide Andover	thin film filter layers	1.45" diam. thin film	zero exposed surface area.
Cryolite Andover	thin film filter layers	1.45" diam. thin film	zero exposed surface area.
Opal glass diffuser Ealing	diffuse light	2 mm thick 1.45" diam.	attenuator must be adhered to this
Schott NG glass	attenute diffuser trans	approx. 2 mm thick 1.45" diam.	*
Aluminum mounting ring	mounting filters	1.45" diam., approx. 9 mm wide	used to seal filter

* Diffuser: An attenuating layer will need to be adhered to the opal glass diffuser to reduce its transmission to the required level for CCD calibration. I suggest adhering a Schott NG neutral density filter to the opal glass diffuser. The final transmission value of the attenuator will depend on the entrance filter's transmission, but the current objective is to use an attenuator which is about 30% transmissive. An Aluminum layer is impractical for such levels of attenuation. T. Cruz is looking into Norland 61 or 81 adhesive to see if any of these adhesives are suitable.

Norland Products, Inc outgassing data

	TML(%)	VCM volatile(%)
NOA 61	1.4	.01 data from Norland, Cure 1Hr -100C
NOA 81	0.93	.03 data from Norland, Cure 1Hr -125C

Data from Nasa Ref. Pub., 1124:

NOA 61	2.24	.01	Cure 1Hr -100C	GSC11479
NOA 61	1.65	.01		GSC11541

FROM: Tom Cruz, EXT: 43952, Date: 6/7/89
Subject: Aspect Sensor Materials
Top Assy Drawing #SXT-2B010

Page 1 of 2

Item #	Material	use	dimensions	comments
1	titanium TI-6AL-4V coated*	housing	approx. 4" long x 3.0" diameter	houses entrance filter + lens
2	titanium TI-6AL-4V uncoated	ring spacer	3.0" diameter	mounting of aspect sensor to instrument
3	titanium TI-6AL-4V uncoated	concentric	3.0" diameter	mounting of aspect sensor to instrument
4	titanium TI-6AL-4V coated*	aft spacer	2.5" diameter	spacer positions aspect lens in housing
5	titanium TI-6AL-4V uncoated	lens retainer	2.5" diameter	threaded ring retains lens
6	titanium TI-6AL-4V uncoated	filter spacer	3.0" diameter	positions entrance filter in housing
7	titanium TI-6AL-4V uncoated	center filter spacer	3.0" diameter	positions entrance filter in housing
8	titanium TI-6AL-4V uncoated	filter retainer	3.0" diameter	threaded ring retains entrance filter
9	synthetic fused silica	forward filter	6 mm thickness x 2.5" diameter	one of two entrance filter glass substrates
10	Hoya CM-500 filter	aft filter	6 mm thickness x 2.5" diameter	one of two entrance filter glass substrates

Aspect Sensor Materials

Top Assy Drawing #SXT-2B010 Page 2 of 2

Item#	Material	Use	Dimensions	Comments
11	BK7-G18 coated**	forward lens (element #1)	5 mm thick x 60 mm diameter	part one of two element lens
12	LF5-G15 coated**	aft lens (element #2)	6 mm thick x 60 mm diameter	part two of two element lens
13	stainless steel 300 series uncoated	lens spacer	2" diameter x .008" thickness	spaces two lens elements apart in housing
N/A	Tiodize Type 2	coating	where this mark * is indicated	chemical conversion primer for chemglaze
N/A	chemglaze flat black paint per LAC 3803-050132	coating	where this mark * is indicated	absorption of scattered light in aspect sensor cell
14	titanium TI-6AL-4V uncoated	clamp	4.5" diameter	mounting of aspect sensor to instrument
N/A	A/R coating broadband multilayer antireflection film	aspect lens	vacuum deposition where this mark ** is indicated	antireflection coatings for lenses both sides of both elements
	Perkin-Elmer entrance filter coatings	coatings	vacuum deposited	attenuation of sunlight + passband definition + blocking; these materials are deposited on both synthetic fused silica and Hoya CM-500 substrates

Antireflection (A/R) Coating for the lenses made by Andover

Newport Thin Films, Inc., provided the following A/R coating materials for the Aspect lenses made by Andover

aluminum oxide
magnesium fluoride
third ingredient is inorganic proprietary material

The representative of Newport Thin Film Laboratory, Mr. Alan Beatty, (714)591-0276, tells us that Newport's proprietary inggredient is not considered a potential contaminant due to outgassing.
Mr. Beatty did not state in what amounts these materials are used for the coating, although we know that since these materials are vacuum -deposited, the deposited amounts are very small.

Andover Adhesives

- T. Cruz FAXed a request to Andover Corporation, requesting a list of the following:

1) Amount of Hexcel Epolite 5314 adhesive used in focal plane filters. (Why don't they use Hexcel Epolite 5313? that has better outgassing properties?)
Hexcel Epolite 5314 was used between the lenses and was also used to pot the filters into their aluminum rings.

   Viggs Co. used to make this product before and it was called Helix 314, then APCO took over making this product and its name became APCO 314 then it was renamed to APCO 5314. Then Hexcel took over making this product, and now it is called Epolite 5314. Hexcel does not have any outgassing data about this product.

2) Exposed surface area of Hexcel Epolite 5314 for one filter is:
   0.0005" thickness x diameter x pi x 2
   = .00129 cm x 3.6 cm diameter x pi x 2 = 0.029 cm^2.
3) Are there any other adhesives used in the focal plane filters? No.
4) The aluminum rings are anodized.

Information from Perkin-Elmer for the aspect sensor entrance filter:

1) Entrance Window:

Front surface, broad band A/R

Coating materials: MgF_2, Ta_2O_5, HfO_2, Al_2O_3

total mechanical thickness: .259 microns.

Rear surface:

Aluminum mechanical thickness: .0554 microns.

Protective film: Al_2O_3, mechanical thickness: .224 microns.

2. Spectral Filter:

Coating materials: Ta_2O_5, approx. 4.0 micron thickness.

SiO_2, approx. 6.0 micron thickness.

Total film thickness (M.T.) approx. 10.0 microns.

Contacts:

Focal Plane filters:
Bill Grenier
Andover Corp.
4 Commercial Dr.
Salem, NH 03079
(603) 893-6888

Entrance Filter:
Matt Houben
Perkin-Elmer Corp.
761 Main Ave.
Norwalk, CT 06859-0001
(203) 762-1000

APPENDIX A

MAINTAINING THE EICA

A.1 RESPONSIBILITY - Lockheed shall maintain this document.

A.2 CHANGE CONTROL -

Both the initial and baselined issues shall have the concurrence of both ISAS and MSFC/LPARL before publication.
Proposed changes shall be processed via exchange of letters and shall have the concurrence (as shown in meeting minutes) of the Solar-A Program Manager, the SXT Principal Investigator, the U.S. Principal Investigator, and MSFC before incorporation into the document.

A.3 CHANGE PROCEDURE -

Proposed changes will be sent to Lockheed who will log them and distribute them for approval. After approval per paragraph A.2, document revision will follow standard Lockheed release procedures.

This page is to ensure the next chapter starts on an odd page.****

APPENDIX B

SCHEDULE OF SXT DELIVERABLES

Table B-1
Hardware Delivery Dates

Item	Ship from USA	Ship from Japan	Responsible
1. Drilling Template - Structural Model	1988.09.20	1988.12.25	Lockheed
2. Drilling Template - FM	1989.10.05		Lockheed
3. Intrument Template (painting mask)	N/A		
4. SXT Electrical Protomodel including Internal cables Camera System Test Set Data System Test Set	1988.07.06	1988.08.22	Lockheed
5. Thermal/Structural Model including Thermal blanket Handling fixture SXT-S container	1988.12.08	1989.07.05	Lockheed
6. Flight Model including SXT-S Thermal blanket FDE CCDE/P Internal cables SXT-S Handling fixture SXT-S container Camera system test set Data system test set	1990.10.15		Lockheed
7. Interface connector - FM	1989.10.20		Lockheed
8. PM GSE including			Lockheed
9. FM GSE including MicroVAX (data analysis equip)	1991.04.01	TBD	Lockheed
10. SXTE-U PM model (S/W Test)	1989.04.		Lockheed
11. SXTE-U PM model (S/W Test)	1989.10.		Lockheed
12. SXTE-J emulator	1989.03.01	1988.03.15	Fujitsu
13. Drill jig/alignment fixture	1988.11.01	1988.12.01	Lockheed
14. Drill jig/alignment fixture	1989.11.15		Lockheed

Table B-2
Documentation Delivery Dates

Item	Ship from USA	Ship from Japan	Responsible
1. SCD (EICA) (S/S Control Document)	1988.06.30		Lockheed
2. System Control Document - Preliminary		1987.11.30	NAOJ/IAUT
3. System Control Document - Final		1988.06.30	NAOJ/IAUT
4. Thermal Mathematical Model -Prelim	1987.12.07		Lockheed
5. Thermal Mathematical Model -Struc Mod.	1988.02.16		Lockheed
6. Thermal Mathematical Model -FM-reduced	1988.11.10		Lockheed
Thermal Mathematical Model -PM "	1989.12.01		Lockheed
7. Structural Mathematical Model -Prelim	1987.11.12		Lockheed
8. Structural Mathematical Model -Struc M	1988.02.02		Lockheed
9. Structural Mathematical Model -PM	1988.11.01		Lockheed
Structural Mathematical Model -FM	1989.04.15		Lockheed
Structural Mathematical Model -reduced		1988.05.30	NEC
10. Drilling Template Interface Drawing		1988.02.25	NEC
11. Drilling Template Drawing - guide line	1988.02.02		Lockheed
12. Drilling Template Drawing - revised	1988.04.05		Lockheed
13. Spacecraft Thermal Model Report		TBD	NEC
14. Spacecraft Structural Model Report		TBD	NEC
15. Painting Specification - preliminary		1988.05.30	NEC
16. Painting Specification - final		1989.02.30	NEC
17. Requirements for Thermal/Struc Model		1987.12.30	NEC
18. Data Format for Thermal/Struc Model		1987.09.18	NEC
19. SXTE-U Software Spec - preliminary	1988.01.19		Lockheed

NOTE:
Items #10 and 11 were deleted.

APPENDIX C

SHUTTER, FILTERS AND ASPECT SUBSYSTEM

C.1 Exposure Levels And Exposure Duration -

The design goals for SXT sector shutter system exposure times are listed in Table C.1-1. The actual shutter open times will vary slightly and are subject to calibration corrections. Exposure times for Frame Transfer and Dark Frame may differ slightly from these values since an 8 millisecond granularity in camera integration is imposed by the camera logic.

Table C.1-1 Effective Exposures

SXTE-J DPE	SXTE-U MBE	10% Mask	Effective Exposure		[DPE: SXTE-J/DP Exposure Level] [MBE: SXTE-U Mailbox Exposure Level]
0	0	Yes	.08	msec	
1	1	Yes	.24	"	
2	0	No	.80	"	
3	2	Yes	1.80	"	
4	1	No	2.40	"	
5	4	Yes	3.80	"	
6	5	Yes	5.80	"	
7	6	Yes	7.80	"	
8	7	Yes	11.80	"	
9	2	No	18.00	"	
10	3	No	28.00	"	
11	4	No	38.00	"	
12	5	No	58.00	"	
13	6	No	78.00	"	
14	7	No	118.00	"	
15	8	No	168.00	"	
16	9	No	238.00	"	
17	10	No	338.00	"	
18	11	No	468.00	"	
19	12	No	668.00	"	
20	13	No	948.00	"	
21	14	No	1.338	sec	
22	15	No	1.888	"	
23	16	No	2.668	"	
24	17	No	3.778	"	
25	18	No	5.338	"	
26	19	No	7.548	"	
27	20	No	10.678	"	
28	21	No	15.108	"	
29	22	No	21.358	"	
30	23	No	30.208	"	
31	24	No	42.718	"	
32	25	No	60.418	"	
33	26	No	85.438	"	
34	27	No	120.828	"	
35	28	No	170.878	"	
36	29	No	241.668	"	
37	30	No	Reserved		[Variable duration via RAM Patch]
38-70	31-63	No	Calibration		[Duration = (MBE - 30)*250 ms]

C.2 Filters -

C.2.1 X-ray Entrance Filters -

Lexan: thickness=1800A, density=1.2 g/cm^3
(polycarbonate, C_16 H_14 O_3)

Al: thickness=900 A, density=2.69 g/cm^3
Ti: thickness=800 A, density=4.50 g/cm^3

There will be two layers of the Entrance Filter, each with the properties given above. The Aluminum layer on the outer filter faces the sun.

C.2.2 X-Ray Analysis Filters -

The SXT filter wheel mechanisms will contain five separate X-ray analysis filters in addition to an open position.

Table C.2-1
SXT X-ray Analysis Filters

Material	Thickness microns	Density	NAME
Aluminum	.14	2.69	AL1400
Al/Mg/Mn	.3/.2/.06	2.69/1.74/7.43	ALMGMN
Magnesium	3	1.74	MG3MU
Aluminum	12	2.69	AL12MU
Beryllium*	100	1.85	BER100

Note that all filters except beryllium assume an 80 percent transmission stainless steel mesh. The ALMGMN filter will be coated on one side with a stabilizing layer of Carbon 140 A thick. The 3 micron Magnesium filter, MG3MU, will be coated on both sides with 140 A Titanium.

Table C.2-2
Filter information

Forward Filter - [Clock Positions as viewed from Xray mirror]

Filter A clock position	Filter Description	Command Parameter Data To Mailbox Address 03H [Desired Filters]
12	Open	X1
2	Neutral Density (aperture Mask)	X6
4	Wide Band, 4600 A (185 A FWHM)	X5
6	Diffuser	X4
8	Quartz Defocusing Lens ('Photon Flood')	X3
10	Narrow Band, 4310 Angstrom (30 A FWHM)	X2

Aft Filter - [Clock Positions as viewed from CCDH]

Filter B clock position	Filter Description	Command Parameter Data To Mailbox Address 03H [Desired Filters]
12	Open	1X
2	AL1400	2X
4	ALMGMN	3X
6	BER100	4X
8	AL12MU	5X
10	MG3MU	6X

X=desired position on other wheel; X=1 if filter not used in combination

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Aug. 1, 1989
Rev. G

Soft X-Ray Telescope Aspect Telescope Design Note # 31
Document SXT-8E051

Pat Grillot and Tom Cruz

The Aspect Telescope package consists of an entrance filter, imaging lens, and two interference filters located in the filter wheel assemblies. The opal glass diffuser, which is used to calibrate the CCD, is also associated with the SXT Aspect Telescope package. The design requirements of the Aspect Telescope are listed in Table 1 below. Component descriptions follow.

Entrance Filter:
The entrance filter consists of a white light attenuator and a bandpass filter. The white light attenuator is composed of a synthetic fused silica substrate, anti-reflection coated on the sunward surface, with an aluminum attenuating layer on the rear surface. The aluminum layer thickness is slightly over 500 A, and it has a dielectric layer overcoating for durability.

The white light attenuator is used in tandem with a bandpass filter whose half-maxima were experimentally determined to be at approximately 3700 A and

4700 A. The transmission of the white light attenuator and the bandpass filter in tandem was experimentally measured as being approximately 1.0 x 10^-4 +/- 5 x 10^-5 from approximately 3600 A to 4650 A. The combined, out of band rejection of the white light attenuator and bandpass filter approaches or surpasses 10^-8 absolute.

Both the white light attenuator and the bandpass filter are positioned in the Aspect Telescope with a 0.5 degree tilt (in opposite directions) to eliminate ghost images. The bandpass filter consists of a 6 mm thick substrate of Hoya Corporation's CM-500. This filter glass attenuates incident radiation from approximately 6700 A to wavelengths beyond 1.1 microns and also attenuates wavelengths shorter than about 3300 A. To further define the entrance filter's bandpass, a far visible-near IR coating has been deposited on the sunward surface of the CM-500. It has been experimentally confirmed that this coating attenuates in the region from approximately 4800 A to approximately 7000 A to 10^-4 absolute or better.

Lens Doublet:
The Aspect Telescope's visible image is formed by a doublet lens, which is achromatic across the entrance filter's passband. The lens has a 50 mm clear aperture and it forms a beam which is approximately f/31. The doublet has a depth of focus of approximately +/- 0.5 mm, with an Airy disk diameter of about 50 microns. Flight and flight-spare lenses have been selected; their effective focal lengths, 1535.27 mm and 1540.7 mm, respectively, give the best match to the measured effective focal length of the SXT X-ray mirror.

The sunward element (element #1) of the doublet is a bi-convex lens composed of Schott BK7-G18, a Cerium stabilized borosilicate crown glass. Element #2 of the doublet is a concave-convex lens made from Schott LF5-G15 radiation damage resistant flint glass. The doublet elements are spaced 0.2 mm apart by a stainless steel ring. Both surfaces of both lenses are anti-reflection coated over the passband of the entrance filter. These lenses assist in attenuating incident light at wavelengths below 4000 A. The half maxima of the complete entrance filter, including lenses, CM-500, dielectric, and aluminum layers are therefore at approximately 4000 A and 4700 A. Additional blocking is provided by the focal plane filters.

Focal Plane Filters:
The Aspect Telescope package includes two interference filters in the focal plane assembly. The narrowband flight and flight- spare filters both have center wavelengths at 4310 A with full width at half maxima (FWHM) of 28 A and 29 A, respectively. The broadband flight and flight-spare filters have 184 A and 185 A FWHM with 4616 A and 4608 A center wavelengths, respectively. The center wavelength of the broadband filters was originally to be located at 4700 A, but the center wavelength was moved to 4600 A to help reduce ghost image intensity (see Appendix A) and to increase the signal to noise ratio of the Aspect Telescope package. Both surfaces of both interference filters are anti-reflection coated at their respective center wavelength.

The narrowband flight and flight-spare filters have maximum transmission values of 33% and 32%, respectively, while the wideband filters both have a maximum transmission of 2.2%. These transmission values were chosen to allow the CCD to be used to maximum efficiency while still controlling ghost image intensity (see Appendix A). The focal plane filters assist in blocking incident light from 3000 A to approximately 4200 A on the short wavelength side. On the long wavelenth side, the narrowband filter assists in attenuating incident light from 4400 A to 5000 A while the wideband filter assists in attenuating incident light from 5200 A to 6500 A.

Diffuser:
CCD in-flight calibration shall be performed by passing sunlight through the entrance filter and an opal glass diffuser in the filter wheel. This will provide approximately uniform illumination on the detector. To allow for the entrance filter's transmission, an attenuator which is 50% transmissive will be adhered to the diffuser. Pre-flight calibration and aliveness testing shall be performed using an infrared emitting diode (mounted on the Aspect Telescope door assembly) and the opal glass diffuser.

Radiation Resistance:
Radiation damage resistant materials were chosen for all optical components of the SXT Aspect Telescope where it was practical. These materials are listed in table 2 below. In the case of the CM-500 substrate used in the entrance filter, radiation damage information was not available, so LPARL scientists performed research on proton radiation damage of CM-500 and Schott Glass Technologies' equivalent BG-39. Both filter glass materials performed very well upon exposure to proton doses as high as one hundred times the expected three year proton dose for the orbit of the Solar-A satellite. A more complete description of the results from this experiment appears in the literature (Grillot and Rosenberg, "Proton Radiation Damage of Optical Filter Glass", Applied Optics, in press). The synthetic fused silica substrate will stop the electrons before they reach the CM-500, preventing electron induced radiation damage. Gamma rays are not expected to cause radiation damage in the CM-500 substrate.

Table 1: Design requirements for SXT Aspect Telescope

Design Data:

2.4e-11	ster/arcsec^2
6.24e+18	eV/s/watt
19.63	cm^2 aperture
2.44x2.44	pixel size in arcsec^2
18.3x18.3	pixel size in micrometer^2
1	electron/photon, CCD conversion constant
2.0e+5	full well capacity of CCD (electrons)
0.35	CCD quantum efficiency at 4600 A
0.30	CCD quantum efficiency at 4300 A
0.25	Measured blue reflectivity of CCD front surface
5.0e-3	dilution factor of light through diffuser to CCD

Design Requirements:

1. Achieve 1/2 full well (10^5 electrons) exposure through opal glass diffuser with 2.0 sec exposure.
2. Achieve 3/4 full well (1.5e+5 electrons) exposure through 30 A (4308 A) and 200 A (4500-4700A) filters in 500 millisec.
3. Ghost image from light reflected from CCD onto 30 A or 200 A filters and back to CCD should be less than 1% of the true image.
4. Signal/noise ratio ~10^2 for the Aspect Telescope in terms of off-band blocking.

Table 2: Aspect Telescope radiation damage resistant materials

Entrance Filter:	1. Synthetic fused silica was chosen in favor of crushed fused silica or fused quartz because of its additional resistance to radiation damage from intense UV, neutrons, protons, electrons and gamma rays. This additional radiation damage resistance is due to the higher purity of synthetic fused silica as opposed to crushed fused silica.
	2. CM-500 was found to be impervious to proton radiation damage at doses of 1000 times the expected three year proton doses for the Solar-A satellite's orbit. BG-39 was found to be impervious to proton radiation damage at doses of 100 times the expected three year proton dose for the Solar-A satellite's orbit.
Doublet Lens:	1. Ceramic materials can be made more radiation damage resistant by adding Cerium as a dopant. Both lenses in the Aspect Telescope lens doublet are cerium stabilized materials. The sunward element of the doublet lens is made of BK7-G18, while the rearward element is made of LF5-G15.
Focal Plane Filters:	1. The focal plane filters are made with Cerium stabilized BK7-G18 substrates.

Appendix: CCD Induced Ghost Images

As with any interface, the CCD surface will reflect a portion of the light that falls upon it. It is not possible to anti-reflection coat the CCD because of the impact to the soft x-ray quantum efficiency. Because the Focal Plane Filters are about 20% reflective and 10% absorbing, the CCD reflection will be partially reflected back onto the CCD to form a secondary image.

Measurements performed at LPARL indicate that the CCD which will be used for the SXT is approximately 25% reflective at 4308 A and at 4600 A, which would yield a 5% secondary image. These ghosts cannot be eliminated from the solar image by tilting the focal plane filters relative to the CCD, however, by incorporating an attenuating glass filter into the Focal Plane Filters this ghost image intensity can be reduced to approximately 1% or less of the primary image intensity. Reaching a 1% ghost intensity requires an absorbing glass which is 45% transmissive to be placed between the dielectric layer of the Focal Plane Filters and the CCD. This absorbing glass in turn places a maximum limit of about 32% on the transmission of the Focal Plane Filters.

Two-and-one-half mm thick pieces of Schott Glass Technologies' UG-5 absorbing glass were used as the attenuators in both sets of focal plane filters.

APPENDIX D

SXTE-U SOFTWARE REQUIREMENTS DOCUMENT

D.1 Introduction -

D.1.1 Document Description -

The first three sections of this document (D.1-D.3) provide an overview of the requirements and structure of SXTE-U microprocessor control software. A working description of the software interface between SXTE-U and SXTE-J is presented in section D.4. That section includes discussion of SXTE-U actions for each SXTE-J command and interpretation of the SXTE-U return values provided for each SXTE-J status request. Error detection and actions are the subject of section D.5.. Section D.6 provides some tabular system data, including memory and I/O maps. More detailed information on the software specifications including implementation and timing considerations is provided in the SXTE-U Software Specifications Document.

D.1.2 Overview Of The Flight Software Task -

The SXTE-U system is controlled by an NSC-800 microprocessor. The major functions of the microprocessor are to configure the SXTE-U peripherals according to command information supplied by DP/SXTE-J and then to initiate and monitor the exposure and readout of the CCD camera data defined by that configuration. SXTE-U system status information is provided to DP/SXTE-J throughout this exposure cycle. The exchange of command and status information is accomplished through a software mailbox and appropriate interrupt service routines.

The setup commands for a given exposure may be issued by the DP/SXTE-J during the exposure and camera read out phases of the previous exposure. These configuration commands may include filter wheel position information, aspect sensor cover state, CCD camera Region Of Interest (ROI) definition, exposure duration, etc. Depending upon the command and phase of the exposure cycle, execution may begin immediately or may be delayed for some event to occur. For example, the filter wheel and aspect sensor cover movements are defered until CCD image readout is complete to avoid EMI noise in the camera data.

A mailbox status flag is set by the microprocessor during mechanism setup and during exposure integration and readout. This flag is cleared when all pending setup commands are complete. DP/SXTE-J may then issue a Start Exposure command to initiate the next exposure. The CCD camera is first commanded into an integrate mode and if required, a command to open the shutter is sent at this time. The end of exposure is indicated when the shutter closes (for shutter timed exposures) or after the requested integration period has passed as indicated by microprocessor monitoring of a hardware timer. At this time, the CCD camera is placed into a readout mode and the microprocessor monitors a camera signal to determine when data transfer to DP/SXTE-J is complete. Setup for the next exposure is then started, including executing any pending mechanism moves, transmission of CCD camera ROI commands, etc.

In addition to normal control of the exposure cycle described above, there are microprocessor functions which occur less frequently. A cold start or reset function occurs at power-on or through a discrete spacecraft command. During the cold start operation, the contents of the microcomputer ROMS are moved to RAM to facilitate patching. The hardware is initialized and the instrument is placed in a known state. A warm reset function verifies RAM code integrity (checksums) and places SXTE-U into a known state while maintaining any patches which have been made since the last cold reset. A day/night command is used to put the instrument in a known state when the spacecraft moves into orbital night, and to prepare it for exposures again at orbital day.

D.1.3 Applicable Documents -

The following documents are applicable to this one:

Fig. 1: APPLICABLE DOCUMENTS

SXT #	NAME
SXT25039	SXT DESCRIPTION AND INTERFACES
SXT8E039	JPL CCD CAMERA INTERFACE CONTROL DOCUMENT

D.2 Flight Software Main Body -

D.2.1 Flight Software Structure -

The SXT instrument flight software is divided into the functional modules listed in the table below:

Fig. 2: SXT SOFTWARE MODULES

*	COLD START
*	WARM START
	MAIN LOOP
*	STATUS OUT
*	COMMAND IN
	COMMAND INTERPRETER
	SHUTTER COMMAND
	FILTER WHEEL COMMAND
	CAMERA COMMAND
	ASPECT SENSOR COVER COMMAND

* (The modules marked with asterisks are wholly contained in interrupt service routines and so are described in the following chapter)

The sections which follow will briefly describe the functionality of each of these modules.

D.2.2 Main Loop -

The main module will be a polling loop of all the tasks for the microcomputer which are not embodied in interrupt service routines. The control will be dispatched to tasks which require some activity, and dormant tasks will be passed by. Control will be returned to the main loop when the called routines pause or complete.

D.2.3 Command Interpreter -

The command interpreter checks the command buffer (implemented as a circular queue) to determine if any commands have been deposited by the Command Interrupt Service Routine. All such commands will cause the Command Interpreter to invoke the appropriate routine as determined by the command's mailbox address. In general, routines invoked by the command interpreter will perform range checking on the associated data value and then setup the data or set control flags as dictated by the particular command and data values in the buffer. After servicing a command, the buffer pointers are advanced to allow processing of the next command in the queue. When all buffered commands have been serviced, the command interpreter is exited and control returns to the main loop.

D.2.4 Shutter Command -

The shutter module is responsible for sending commands to the shutter and monitoring shutter position and status. The shutter position encoder value as well as the shutter open/closed status are maintained as mailbox status locations. The following shutter functions are controlled by the microprocessor:

Fig. 3: SHUTTER FUNCTIONS

1. Shutter Open
2. Shutter Close
3. Sweep 3 degree slit past CCD (1 millisecond exposure)
4. Inquire position (5 bit encoder output)
5. Sweep 60 degree slit past CCD with specified dwell

D.2.5 Filter Wheel Command -

The filter wheel module controls the position of the two filter wheels by pulsing the stepper motor driver electronics. Filter position information is used by the microprocessor to determine success or failure at reaching or maintaining the desired position. The position information is made available to the mailbox through a status location. Filter control signals for each wheel consist of independent enable and direction signals and a shared pulse signal. Both wheels may be moved at once to assure positioning within a maximum time of one second. The filter pulse signal is a 50 % duty cycle square wave with a minimum frequency of 180 HZ. generated by microprocessor configuration and control of a pair of hardware timers (NSC810).

D.2.6 Aspect Sensor Cover Command -

This module is responsible for control of the Aspect Sensor Cover motion and monitoring of position status. The Aspect Sensor Cover may be opened or closed through microprocessor commands. Position information is used by the microprocessor to determine success or failure at reaching or maintaining the desired state. The microprocessor maintains a status flag in mailbox memory to reflect the current state.

D.2.7 CCD Camera -

The camera module is responsible for controlling the CCD camera operations and monitoring camera status. Microprocessor camera control signals consist of a command data line and a clock signal through which serial commands of either 8 or 1032 bits in length are transmitted to the camera. CCD camera configuration and status information is maintained in the mailbox. This configuration data includes camera state (integrate, readout, idle) and image parameters such as ROI number, location, and size and image resolution. CCD temperture is latched by SXTE-U and inserted into the mailbox by the microprocessor. During CCD camera readout, a FIFO device on the SXTE-U camera interface board stores an echo of the camera long word RAMs. The microprocessor compares that data with the long words transmitted earlier to verify camera command transmission, reception, and camera long word function. The major camera long and short word command functions are outlined below. For a detailed description CCD camera command interface, see the JPL CCD Camera Interface Control Document.

Fig. 4: CCD Short Word Functions

1. Integrate and Readout Start
2. Horizontal (Serial) Summing Mode
3. Full Frame Flush
4. CCD Temperature Readout

Fig. 5: CCD Long Word Commands

1. Regions Of Interest (ROI)
2. Vertical (parallel) Summing
3. Fast line parallel transfer (line skipping)
4. Serial Line Flush Control (pre ROI guard band)

D.3 Interrupts And Microprocessor Resets -

D.3.1 Interrupt Structure -

The NSC-800 processor has five hardware interrupts in the configuration in which it is used in the SXT instrument. This section will briefly outline the functions of each of the interrupt service routines and also outline the microprocessor functions during a reset operation. The reset differs from a true interrupt in that no 'return' to the interrupted code is possible.

D.3.2 Interrupt Service Routine Descriptions -

D.3.2.1 Reset (Cold Start) -

This is the cold reset of the microprocessor. The event will occur either at power-on time or on discrete command from the DP/SXTE-J. The reset routine will initialize ram locations, move the bulk of the code from ROM to RAM (to facilitate patching) and set up the hardware. Hardware setup will consist of setting direction of the NSC-810 I/O ports, and other operations concerned with preparing the instrument to start work. Control will then be transferred to the main loop.

D.3.2.2 NMI Soft Reset (Warm Start) -

The Non Maskable Interrupt (NMI) used in SXTE-U is dedicated to a "Soft Reset function". As the name implies, response to this interrupt may not be turned off (masked). The event will occur on DP/SXTE-J discrete command. The routine started by this event will conduct an analysis of the instrument condition and take appropriate measures to restore function. Such analysis will include comparisons of selected code areas via one or more CRC (cyclic redundancy checksums) verifications. The results of the CRC computations are compared with results obtained earlier to assure that code corruption has not occured. Important microprocessor parameter and variable values will be initialized if such action is required to retore operations and the system will be placed in a predefined state. Control will then be transferred to the main loop.

D.3.2.3 INTR Shutter Interrupt -

The interrupt can occur on shutter open and/or shutter close transitions, depending upon the parallel port bit programmed from the microprocessor. This routine is used to initialize timer parameters and to provide a flag to the microprocessor reflecting the shutter state. Upon completion, control is returned to the interrupted code.

D.3.2.4 RSTA DP/SXTE-J Status Request -

The status interrupt occurs whenever the DP/SXTE-J requests the contents of a mailbox location from SXTE-U. It indicates that the DP/SXTE-J has provided a mailbox address, and is waiting for the contents of the mailbox to be reported. The interrupt service routine fetches the contents of the address latch, and using this as a pointer into the mailbox, fetches the contents of the appropriate location from memory and outputs it to the DP/SXTE-J. A " status ready" line is strobed to indicate to the DP/SXTE-J that the requested status data is available on the bus (or status return latch). Upon completion, control is returned to the interrupted code.

D.3.2.5 RSTB DP/SXTE-J Command Strobe -

The command interrupt occurs whenever the DP/SXTE-J issues a command to the SXT instrument. It indicates that the DP/SXTE-J has placed a mailbox address and mailbox data in the command latch, and has issued a command strobe. The interrupt service routine will first examine the command to determine if it is necessary to execute it immediately. If not, the command is put in a command buffer for later action via the Command Interpreter. The command buffer is checked for overflow and then control is returned to the interrupted code.

D.3.2.6 RSTC CCD Camera Line Sync 1 -

The CCD generates a line sync 1 signal every 8.1 milliseconds while the CCD camera is powered on. This signal is used by the SXTE-U microprocessor to synchronize transmission of integrate and readout short (8 bit words) CCD command words. This allows more accurate timing of the exposure times especially in modes when the shutter is not used (Dark Frame and Frame Transfer exposures). The response to this interrupt signal is only enabled immediatly before transmission of the desired short word. The interrupt service routine will start (integrate) or stop (read) the exposure duration clock during non-shutter exposures and then transmit the appropriate short word to the CCD camera. CCD response to that short word starts at the next (8.1 milliseconds later) line sync one signal. On exit from this interrupt service routine, only interrupts to Status and Command will get enabled. In general, only two excutions of this routine are executed per exposure cycle. Control is returned to the interrupted code on completion.

D.4 Mailbox -

D.4.1 Introduction -

The Mailbox is an area of SXTE-U RAM dedicated to the exchange of command and status information with SXTE-J/DP. The definition and interpretation of each defined Mailbox address is provided in this chapter.

D.4.2 Mailbox Layout -

The layout of the mailbox is described in EICA Table 5.3-1.

D.4.3 Mailbox Descriptions -

This section briefly describes the contents of each mailbox location. For command locations, the major actions taken in response to a command write are reviewed. Whenever possible, these actions are related to other events in the SXT exposure process or to internal microprocessor events. The effect of the actions on various status quantities are also mentioned. For status memory locations, a description of the returned value is presented. The timing of status value updates with respect to other events is discussed.

D.4.3.1 Location 00H Shutter Mode (Command) -

A command value of zero requests use of the Frame Transfer mode for the subsequent exposure. This feature provides backup exposure capability under certain shutter mechanism failure scenarios. Implementation includes using CCD short commands to control exposure time, and CCD long commands for readout. The long commands provide the ability to rapidly shift the ROI rows into an off sun region of the CCD ('southern most' CCD rows). The slower serial readout of the ROI rows can then take place without additional solar source CCD charge buildup.

A command value of one indicates a standard exposure request using the shutter or a dark exposure request as specified in Locations 0EH and 0FH.

D.4.3.2 Location 01H Flush Count (Command/Status) -

The high order nibble indicates the number of serial line flushes performed immediately preceding readout of an ROI. The actual number of flushes performed is equal to (Command-Value * 4).This type of flush operation is controlled through the CCD long command bit patterns. Each line flushed adds 8.1 milliseconds to the image readout time.

| The low order nibble indicates the number of full frame flushes to perform.

This nibble is subdivided into two fields to allow flushes during different phases of the exposure cycle. Bits 2 and 3 (field BB in Table 5.3-1) designate the number of flushes to execute during the setup phase of an exposure. The number of flushes executed is twice the command value. If an exposure is in progress when this field is commanded (non zero), these flushes will execute immediately following the completion of the camera readout for the preceding exposure - thus, they are done concurrently with filter wheel and aspect door positioning (and immediately following long word transmission if applicable). If this field is commanded during the setup phase (when CCD is idle), the flushes are performed upon command receipt. These flushes do not contribute to exposure latency.

Bits 0 and 1 (field AA in Table 5.3-1) indicate the number of full frame flushes to execute between the receipt of the exposure start command (from SXTE-J/DP) and the start of camera integration. The purpose of flushes at this time is to clear dark current which has accumulated between the last camera readout or full frame flush (executed during the setup phase) and the integration start. This could be significant if the CCD is running warm (TEC off) and/or the SXTE-J/DP telemetry rate is medium (interexposure time at least 16 seconds). Such flushes do contribute to the exposure latency - failure to properly constrain the value (in conjunction with exposure level and guard band) could cause a one major frame gap in exposure cadence. This is particularily true in high telemetry rate (interexposure time 2 seconds) and for 1 and .5 second cadence exposures.

This mailbox location is updated within the Command Interrupt Service Routine.

On status request, the most recently commanded value is returned.

D.4.3.3 Location 02H Day/Night Mode (Command) -

A command value of zero initiates night mode actions, including cancelling pending peripheral commands, completion or termination of current exposure as appropriate and setting the Day/Night status flag (010H, bit E). SXTS peripherals are then configured to allow photon flooding of the CCD (Section 5.3.10). The microprocessor will inhibit mailbox mechanism commands received during night.

A non zero command value initiates night to day actions, including comparison of mechanism status to previous day status, clearing the status flag (010H, bit E) and, resetting mechanisms to nominal day modes.

D.4.3.4 Location 03H Desired Filters (Command/Status) -

The command value written to this location specifies the filter positions desired for the subsequent exposure. Each of the two three bit fields is interpreted as the filter position number as defined by the primary filter encoder outputs. Each filter wheel contains six filters, numbered one through six. The low nibble of the command byte specifies the position for filter wheel A, and the high nibble specifies the filter wheel B position. Wheel A is the one located on the metering tube end of the Filter Wheel Assembly (FWA); Wheel B is located on the CCD camera head end of the FWA. If either nibble is zero, no move will be executed for the corresponding wheel.

If one or both wheels are already positioned at the command value, then the corresponding wheel(s) will not move. If the command is received during the integration or readout phase of an exposure, the filter movement is defered until CCD readout is completed to minimize EMI noise in the image data. The maximum time required to position both wheels to the commmanded value is one second, barring any hardware problems. This mailbox location is updated in the Command Interrupt Service Routine.

On status request, the most recent commanded value of this location is returned.

D.4.3.5 Location 04H Aspect Sensor Cover (Command) -

A command value of 00H is a request to cover the Aspect Sensor. A value of 01H is a request to uncover the sensor. Actions will only occur if the new command would result in a change of state. The appropriate bit in the status word (Location 010H) is set or cleared as appropriate.

D.4.3.6 Location 05H Image Resolution/Compression/# Exposures (Command/Status) -

On command, the resolution field specifies full (no summing), half (sum 2x2), or quarter (sum 4x4) image resolution. This is implemented via the CCD long and short words as outlined in section 2.6.1. The data compression field specifies the compression algorithm for the 12 bit CCD pixel values. This feature is implemented via output to the appropriate NSC 810 port. The third field of this location specifies the number of ROI desired in the subsequent image. This field represents on of several quantities required to format the CCD long commands. The remaining field of this location specifies the number of exposures which will SXTE-U will execute upon receipt of the SXTE-J exposure command. Request for two exposures (field value = 01) results in an interexposure time of approximately 1 second. Four exposures (field value = 10) will have an interexposure time of approximately one half second. This mailbox location will update within the Command Interrupt Service Routine.

On status request, the most recently commanded value is returned.

D.4.3.7 Location 06H ROI 1 Starting Row (Command/Status) -

On command, this value specifies the bottom (lowest CCD row number) CCD row containing data of interest. The command value is related to the actual CCD row number by: [CCD Row = (command value * 4)] . Thus, a command value of 0 specifies CCD row 0 and a command value of 255 specifies CCD row 1020. When combined with the ROI 1 width (next location), along with the associated starting rows and widths for up to three additional ROIs, the proper CCD long word (North-South bit map) may be derived. Locations 08H, 0AH, and 0CH define the start rows for ROIs 2, 3, and 4 respectively. These mailbox locations are updated within the Command Interrupt Service Routine.

On status request, the most recent commanded values are returned.

D.4.3.8 Location 07H ROI 1 Width (Command/Status) -

On command, this value specifies the number of CCD rows included in ROI. The command value is related to the actual CCD row number by: [CCD Rows = (command value * 4) + 4].Locations 09H, 0BH, and 0DH define widths for ROIs 2, 3, and 4 respectively. These locations are updated within the Command Interrupt Service Routine.

On status request, the most recent commanded values of these location are returned.

D.4.3.9 Location 0EH Exposure Level (Command/Status) -

On command, this value specifies a unique exposure duration as outlined in Appendix C, Table C.1-1.

For shutter exposures under one second, the exposure time is controlled by the shutter electronics. In these cases, a single shutter command causes the shutter to open and close, with the shutter-open time specified by the particular shutter command transmitted. For all non shutter exposures (Frame Transfer and Dark Frame exposure) and for shutter exposures over one second in duration, the exposure time is controlled by polling a hardware timer - the exposure is terminated when the desired period has passed. For the shutter case, these longer exposures require two commands to explicitly open and close the shutter. For both shutter and non shutter modes, the actual exposure time obtained is measured by the hardware timers and is externalized through a different, status only mailbox location (Exposure Duration). For shutter modes, this is the total time that the shutter was open during the integration period of the CCD. For non shutter modes, the actual exposure duration is measured from the time the CCD starts integrating to the time the readout begins. Since the CCD change of state (from integrate to read) has a granularity of about 8.1 milliseconds, it should be noted that exposure levels of zero(0) and one(1) will result in exposure times of at least 8.1 milliseconds for Frame Transfer and Dark Frame modes. This mailbox location is updated within the Command Service Interrupt Routine.

On status request, the most recent commanded value is returned.

D.4.3.10 Location 0FH Exposure Command (Command) -

A command value of 00H is an 'Abort Exposure' request. At this time, SXTE-U will clear any pending mechanism setup commands. Mechanism movements already in progress will complete. If a microprocessor timed exposure is in progress, the integration period will terminate and CCD camera readout will initiate. The abort will have no effect on the camera data transferred across the interface. The mailbox exposure duration will reflect the actual integration time of the aborted exposure. An abort request received during camera readout has no effect on the camera data. A command value of 01H will initiate a standard SXT exposure sequence. Actions include assuring setup is complete, and execution of pending commands in the order specified by the command interpreter. These queued include shutter command(s), and commands to flush, integrate and readout the CCD system. A command value of 02H will initiate a dark exposure. Command actions are identical to the standard exposure described above with the exception of the shutter commands. The shutter remains closed during dark exposures to provide background calibration data. A command value of 03H initiates a CCD Camera calibration sequence. In this mode, the shutter is opened immediately prior to initiation of the camera readout and left open throughout the readout. In this way, each line out of the camera is exposed for 8.1 milliseconds more then the preceding line and (if other parameters are set correctly) is useful for light transfer calibrations.

Command writes to this location only occur on the major frame sync. The actions described will effect bits in the Status1 word at Location 010H.

D.4.3.11 Location 010H Status 1 (Status) -

This status only word reflects the actual state of the SXT shutter, CCD, and Aspect Cover subsystems. Additional fields indicate which of the two microprocessor subsystem is active and whether the system is in day or night mode. The fields in this word will update as soon as feasible after a state transition is detected within the appropriate Interrupt Service Routine or via main loop sampling as applicable.

D.4.3.12 Location 011H Status 2 (Status) -

This status only word reflects the actual state of the filter wheel subsystem, including wheel A and B positions and a flag indicating filoter wheel motion. As for status1, these values will reflect the most recent data available, in this case via main loop sampling of the encoders. An additional flag indicates setup state. This "setup in progress" flag is cleared when the microprocessor is ready to initiate an exposure and is set otherwise.

D.4.3.13 Location 012H Error Code 1 (Status/Command) -

This word indicates mechanism and command errors. The meaning of the various fields and the error conditions they monitor is fully described in the section of this document entitled Error Defintions and Response. A command write to this location clears (zeros) all error bits. This word is also cleared during hard and soft reset operations.

D.4.3.14 Location 013H CCD Temperature (Status) -

Status only word which reflects the most recent CCD temperature reading. This value is updated during the readout of the CCD camera as initiated within the main processing loop.

D.4.3.15 Location 014H - 01AH Error Counters (Command/Status) -

These locations maintain the counts for each of the associated error conditions. See Chapter 6 for a discussion of each condition. For each of these, the value returned on a status request will reflect the most recent value of the counter as maintained within the main processing loop. Command writes to these locations will zero the associated counter.

D.4.3.16 Location 01BH-01CH Measured Exposure Latency (Status) -

This status word reflects the time between receipt of the SXTE-J start exposure command and either the actual shutter open time (for shutter exposures) or the start of CCD camera integration (for Frame Transfer exposures). This time is measured via an NSC 810 hardware timer. The value returned on a status request is the most recent value as maintained within the main processing loop.

D.4.3.17 Location 01DH-01EH Measured Exposure Duration (Status) -

This status word reflects the actual time the shutter remains open (or integration time if Frame Transfer mode), as measured by the microprocessor via an NSC 810 timer.

D.4.3.18 Location 01FH Status 4 -

The LSB (field A in Fig 5.3-1) of this status only word indicates the status of the SXTE-U Initial Program Load (ROM to RAM copy). The two bit aspect sensor door encoder is echoed in field BB. Field C indicates the microprocessor state (post reset or normal). The bit is set during reset operations (hard and soft) and cleared by the first microprocessor DAY command follwing the reset.

D.4.3.19 Location 020H Exposure Resolution (Status) -

This value represents the time resolution of the current exposure and defines the time resolution attached to the measured Exposure Duration in Locations 01DH/01EH. This quantity is defined by the specific Exposure Level (0EH) specified.

D.4.3.20 Location 021H Status 3 (Status) -

Bits 0 through 4 of this word echo the five bit shutter encoder word most recently obtained within the main processing loop. An additional flag bit (bit 5) is set if the shutter was in the timed open state at sampling time - in this case the shutter encoder sampling is skipped. The remaining field (bits 6 and 7) indicate the type of CCD camera data which will result from the most recent Exposure commmand (write to 0FH). The bits are cleared at the night to day transition. Possible camera data types are normal, dark frame and calibration data. The field is updated when the Exposure Command is interpreted.

D.4.3.21 Location 022H Error Code 2 (Command/Status) -

This word indicates CCD camera and various processing errors. The meaning of the various fields and the error conditions they monitor is fully described in the section of this document entitled Error Defintions and Response. A command write to this location clears (zeros) all error bits. This word is also cleared during hard and soft reset operations.

D.4.3.22 Location 023H Readback Test (Command/Status) -

This location is designed to allow testing of the SXTEJ/SXTEU interface. A command write to this location causes the command value to be copied into status memory - this update occurs within the Command Interrupt Service Routine. A status request will return the most recent commanded value.

D.4.3.23 Location 024H Watchdog Byte (Command/Status) -

On command write to this address, the microprocessor will queue a command to increment the value in this location. A status request will return the current value. The DP/SXTE-J can then use this byte as follows:
a) Issue a status request to obtain the current watchdog byte value.
b) Issue one or more command writes to this address
c) Issue another status request to return the current value

If the watchdog byte value obtained in the second status request equals the first value plus the number of intervening command writes, that is a good indication that the command write, status request, main loop, and command interpreter modules are all functioning properly. Partial success/failure in this test should assist in troubleshooting the problem.

D.4.3.24 Locations 025H-026H Ram Patch Address (Command/Status) -

These locations contain a pointer to memory which is utilized by the RAM Patch Read and RAM Patch Write utilities. Command writes to location 025H will update the high byte of the pointer to the command data. Command writes to location 026H update the low byte to the command data. Such updates occur within the Command Interrupt Service Routine. These values also change when either the RAM Patch Read or RAM Patch Write locations are accesed since both of those utilities increment this memory pointer. On Status Request, the current value is returned.

D.4.3.25 Location 027H Ram Patch Read (Status) -

A status request to this location will return the eight bit value in the memory location indicated by the current value of the RAM Patch Address (locations 025H/026H). After fetching the data, the RAM Patch Address is incremented to facilitate consecutive memory location reads.

D.4.3.26 Location 028H Ram Patch Write (Command) -

A command write to this location will write the command data value to the memory location indicated by the RAM Patch Address (locations 025H/026H). After writing the data to memory, the RAM Patch Address is incremented to facilitate consecutive memory location writes.

D.4.3.27 Locations 029H-02AH Command Counter (Status) -

This two byte counter will monitor the total number of valid commands received from the DP/SXTE-J since the last microprocessor reset (via +5V power on or discrete HARD or SOFT reset command). A status request will return the most recent value as updated within the main processing loop. Note that since this is a two byte location, two status requests are required.

D.4.3.28 Locations 02BH-02DH Shutter Movement Count (Status/Command) -

Three byte counter which will track the number of shutter mechanism movements to provide an indicator of bearing wear. A status request will return the most recent value of the specified mailbox location, as updated within the main processing loop. Command writes to each of the three locations will update the corresponding location with the commanded value. This allows restoration of the pre power down values after power up.

D.4.3.29 Locations 02EH-030H Filter A Movement (Status/Command) -

Odometer monitoring Filter wheel A travel. Status request and command comments for Location 02BH apply.

D.4.3.30 Locations 031H-033H Filter B Movement (Status/Command) -

Odometer monitoring Filter wheel B travel. Status request and command comments for Location 02BH apply.

D.4.3.31 Locations 034H-035H Aspect Movement Count (Status/Command) -

Counter which monitors the number of aspect cover commands since microprocessor reset. Status request and command comments apply.

D.5 RAM Utilization -

SXTE-U RAM allocation map

Address(HEX)		
Start	End	Item
4000	46FF	ROM 0 Image (excluding page 0) - SXTE-U Code and Variables
4700	4EFF	ROM 1 Image - SXTE-U Code and Variables
4F00	4F21	Secondary Interupt Vector Table
4F30	4F5F	Hard Reset Checksum Table
4F60	4F8F	Soft Reset Checksum Table
5000	50FF	Dynamic Variables
5100	51FF	Command Buffer (circular queue - last 128 commands and data)
5200	5235	Mailbox
5300	53FF	Mailbox - access masks
5400	54FF	Camera Long Word Buffer - next words to transmit
5500	55FF	Camera Long Word Buffer - last words transmitted
5600	56FF	Camera Long Word Buffer - camera long word echo (FIFO)
5700	[5FDF]	Available RAM (End address determined by maximum stack depth)
[5FE0]	5FFF	Stack (Start address determined by maximum stack depth)

D.5.1 Command Buffer Organization - The SXTE-U command buffer is organized as a circular queue with an allocation of 256 bytes. The LSB of each two byte queue entry is the mailbox address, the MSB is the corresponding data byte. Since two bytes are utilized for each queued command, the most recent 128 commands and associated data are accessible (via RAM read mailbox utility) for diagnostics and trouble shooting. Two pointers are used for queue management to handle insertions via the Command Interupt routine and subsequent processing via the Command Interpreter. Note that only certain mailbox commands are queued - commands which only require uProcessor memory access are serviced entirely within the Command Interupt Service Routine and are not queued.

D.6 Hardware Map -

D.6.1 Memory Space -

This table is a description of the location in memory of the physical devices which make up the microcomputer of the SXT instrument.

The NSC-800 address space is divided into two areas, one for memory and one for input/output. This section describes the hardware in the memory space, and the following one describes the I/O space.

Memory Space

Location Begin (hex)	End	Size 1K=1024 bytes	Noun	
0	07FF	2K	Rom 0	Interrupt Vectors, Control Software
02000	027FF	2K	Rom 1	The rest of the code
04000	05FFF	8K	RAM	(the ROMS are moved into the RAM to allow code patching, the variables are here, along with the mailbox)
08000	0FFFF	32K	TAB	this is the memory space accessible to the Test Accessory Box (TAB)

D.6.2 I/O Space -

This section provides a brief description of the hardware in the I/O space.

I/O SPACE

Location (hex)	Device	Description
0	NSC-810	PA- interrupt flip-flop control PB- general purpose bus to DP/SXTE-J status data out to shutter box from DP/SXTE-J address latch from DP/SXTE-J command latch shutter position PC- Status Ready, 2.5 MHz. Timer
020	NSC-810	PA-0 thru 5 Filter Position PA-7 Serial in (CCD command) PB-0 Filter Enable A -1 Filter Enable B -2 Filter Direction A -3 Filter Direction B -4 LED Power A -5 LED Power B -6 Frame Gate (CCD Data Envelope) -7 CCD camera Line Sync 1 PC- filter pulse, exposure duration
040	NSC-810	PA- shutter control PB- general purpose bus address PC- timer
080 thru 0FF		TAB I/O space

D.7 REVISIONS -

D.7.1 June 23, 1988 -

The following revisions were incorporated on June 23, 1988:

1. altered description of 'setup in progress' bit
2. altered reference to SXTE-J/DP redout clock
3. rewrote CCD command description to incorporate new long word definitions
4. deleted all references to EICA appendix A and incorporated applicable text into this Appendix
5. update of mailbox layout:
    1. address 01H, flush count - split into two four bit fields and include appropriate text
    2. address 07H/09H/0BH/0DH, roi widths - upper limit changed to 0FFH
    3. address 012H, error word, change bit G text to Invalid Mailbox Access
    4. address 02BH-033H, shutter and filter odometers - change 'Odometer' reference to reflect redefinition as mechanism movement counters
6. Update to mailbox descriptions :
    1. address 01H, flush count - included brief description of second field
    2. address 025H-028H, ram patch, included descriptions and deleted references to Appendix A
    3. address 02BH-033H, shutter and filter odometers - changed descriptions to reflect redefinition as mechanism movement counters.
7. updated error word, bit G definition
8. deleted old section 4 describing SXTE-J / SXTE-U timing relations since information appears elsewhere in EICA

D.7.2 September 22, 1988 -

The following revisions were incorporated on September 22, 1988:

1. rewrote various portions of text to clarify language
2. updated exposure level description to include level 0 and 1 specification for non shutter modes
3. deleted much of camera command section and included reference to the JPL CCD Camera ICD
4. deleted figure (old FIG. 5) of interrupt vectors - too detailed for this document
5. added missing Aspect Sensor Cover Command module description
6. updated description of valid range of filter positions FROM zero thrrough five (0 - 5) TO one through six (1 - 6).
7. references to systems 0 and 1 were changed to A and B respectively per new definitions
8. minor (typographical, wording, etc.) errors corrected

D.7.3 December 1, 1988 -

The following revisions were incorporated on December 1, 1988

1. updated mailbox locations to include interface for one second and half second cadence exposures (location $ 05H)
2. location $ 01FH which had previously contained exposure latency resolution is now spare
3. location $ 022H which had previously been spare was updated to contain Error Code 2
4. location $ 010 (Status Word 1) most significant bit now indicates normal/aborted exposure
5. moved the section on error reporting and actions to the EICA main body, chapter 5

D.7.4 February 1, 1989 -

The following revisions were incorporated on February 1, 1989

1. implemented camera calibration description and interface
2. Updated Exposure Command definition (Location 0FH) to include a Start Calibration command
3. Renamed status only location $ 021H from Shutter Encoder to Status 3 and added a new field to report camera data type

D.7.5 June 6, 1989 -

The following revision was incorporated on June 6, 1989

1. replaced exposure level table in D.4.3.9 (formerly Figure 7) with a reference to Appendix C Table C.1-1.

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APPENDIX E

DETAILED SXTE-U SOFTWARE SPECIFICATION

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APPENDIX F

DETAILED SXTE-J SOFTWARE SPECIFICATION

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APPENDIX G

SXTS THERMAL MATH MODEL

G.1 Introduction -

The Soft X-Ray Telescope (SXT) is an instrument on the Solar-A satellite, The Reduced Thermal Math Model (RTMM) for this instrument is defined in the following document. The RTMM has been constructed from the Detailed Thermal Math Model (DTMM).

The description following applies to the Flight Model (FM) SXTS. Wherever the Structural - Thermal model (STM) properties are different from those of the FM, the applicable values are supplied in brackets [].

The DTMM has over 100 nodes describing the SXTS. The large number of nodes allows for a high level of accuracy in determining the temperatures the instrument will obtain. However, in order to integrate the SXTS model into the spacecraft model, the total number of nodes must be reduced. Therefore, the 20-node RTMM was constructed. The RTMM results are compared to the DTMM results to verify that the predicted temperatures are correct. The RTMM data presented in the following document should be used in the spacecraft thermal model.

In order to obtain the worst case cold (WCC) and worst case hot (WCH) temperatures (for both the RTMM and DTMM), two Beta angles were used (0 and 55). The Beta angle is defined as the angle between the sun and the orbit plane. The absorbed heat rates for these cases were calculated by a separate Lockheed HEAT TRACE computer program. The HEAT TRACE program takes into account many factors including the Beta angle, the orbit altitude, the temperatures of the sun and the earth, the geometry and surface properties (a/e) of the instrument, the orientation of the spacecraft, and the specularity of the surfaces. The average heat rates through one orbit are used for the calculations. These values are a function of the exact spacecraft front end geometry, specific orbit, and spacecraft orientation and should be verified by NEC calculations.
The orbit altitude was assumed to be 600 km. The temperature of the sun was assumed to be a nominal value of 5766 K, and the temperature of the earth was assumed to be 248 K. The albedo factor was taken as 0.30. The spacecraft is inertial with the SXTS aperture always pointing at the sun. The Beta angles of 0- and 55-deg result in eclipse factors of 0.36 and 0.25 respectively.

G.2 Applicable Documents -

Many mechanical drawings were used to determine the proper geometry to use for the DTMM resistance and heat rate calculations. They were:

Drawing Number	Title
SXT-2M001	Solar-A/SXT
SXT-2A001	Ent Aperture Plate, OGA
SXT-2A006	EAFA Filter Frame
SXT-2A002	Front OGA Plate
SXT-2A011	Outer Mirror Housing Ring
SXT-2A003	Forward Support Plate
SXT-2A008	Inner Mirror Housing Ring
SXT-2B007	Lens Housing Ring
SXT-2C012	Front End Support
SXT-2C001	Metering Tube Attch Ring
- -	Mirror Fingers
SXT-25C60	TEC Thermal Strap
SXT-2A029	Sun Shield
SXT-2C006	Aft Support Plate
SXT-2C007	Aft Support Mount Plate
SXT-2A009	Closeout Plate, OGA

EAFA - Entrance Aperture Filter Assembly
OGA - Objective Group Assembly

The Experiment Interface Control Agreement (EICA), Table 3.2-1, contains the dissipated powers used in the analysis. The temperature requirements are given in table 3.1-2 of the EICA. The orbit parameters come from the EICA, Section 7.3. The spacecraft boundary temperatures used were those given in the NEC SOLAR-A-1743, October 27, 1989.
The temperatures from this report have been condensed to fit the 20 node representation used here for the spacecraft.

G.3 Thermal Requirements -

There are several components of the SXTS which must be within a specified temperature range in order to operate properly. In Table G.3-1 the temperature requirements have been divided into three ranges: operational, functional, and survival. To assure nominal performance, the temperatures must be within the operational range. Degraded performance would occur if the temperatures were within the functional range but outside the operating range. Degradation would occur in the image resolution, and CCD Camera dark current effect. Finally, to assure that irreversible damage is not done to the SXT instrument, temperatures must be kept within the survival range.

Table G.3-1
SXT Temperature Requirements

COMPONENT	TEMPERATURE RANGE (C)		
	OPERATING	FUNCTIONAL	SURVIVAL
SXTS	0/+25	-10/+30	-30/+60
TEC HOT END AT CAMERA HEAD	-17/+20	-25/+30	-30/+60
SXTS AFT MOUNTING, I/F A1	0/+25	-10/+30	-30/+60
TEC THERMAL SHUNT, I/F F	-20/+11	-28/+30	-30/+60
SXTS FRONT MOUNTING, I/F A2	0/+25	-10/+30	-30/+60
CCD CAMERA ELECT/POWER SUP(CCDE/P)	-20/+40	-30/+50	-30/+60
FILTER WHEEL ELECTRONICS (FDE)	-20/+40	-30/+50	-30/+60
SXTE-U PROCESSOR ELECT BOX (SXTE-U)	-20/+40	-30/+50	-30/+60

NOTE:
I/F indicates interface A1, A2, or F shown in Figure G.3-1

The temperature gradient between the front (XRMA +Z end) and the rear supports shall be less than 25 C with a goal of keeping the front end warmer. The circumferential gradient (X or Y direction) shall be less than 10 C.

The following table gives the temperature limits of each thermal math model node.

Table G.3-2
SXTS RTMM node temperature requirement

Node No.	Description	Temperature range (C)		
		OPERATING	FUNCTIONAL	SURVIVAL
1	ASPECT SENSOR(LENS)	0/25	-10/30	-30/60
2	MIRROR	0/25	-10/30	-30/60
3	METERING TUBE	0/25	-10/30	-30/60
4	METERING TUBE	0/25	-10/30	-30/60
5	METERING TUBE	0/25	-10/30	-30/60
6	METERING TUBE	0/25	-10/30	-30/60
7	METERING TUBE	0/25	-10/30	-30/60
8	FILTER WHEEL HOUSING	0/25	-10/30	-30/60
9	TEC HOT END	-17/20	-25/30	-30/60
10	REAR SUPPORT UPPER	0/25	-10/30	-30/60
11	REAR SUPPORT LOWER	0/25	-10/30	-30/60
12	FRONT SUPPORT	0/25	-10/30	-30/60
13	FRONT SUPPORT PLATE	0/25	-10/30	-30/60
14	FRONT END/APERTURE	0/25	-10/30	-30/60
15	OUTER HOUSING RING	0/25	-10/30	-30/60
23	METERING TUBE MLI	Not specified		
24	METERING TUBE MLI	Not specified		
25	METERING TUBE MLI	Not specified		
26	METERING TUBE MLI	Not specified		
27	METERING TUBE MLI	Not specified		

NOTE: If the TEC hot end goes below the required operating limit of -17 C, then the temperature feedback control of the TEC cold end will be ineffective. This means that instead of the CCD operating at -20 C +/-0.1 C, it will operate at a wider (unknown) margin. The temperature of the CCD affects gain and dark current. As no laboratory data exists on the range of thermal instability in this condition, the seriousness of this condition is difficult to assess.

A description of the SXT power dissipations is given in Table G.3-3. This table is the same as Table 3.2-1 in the EICA.

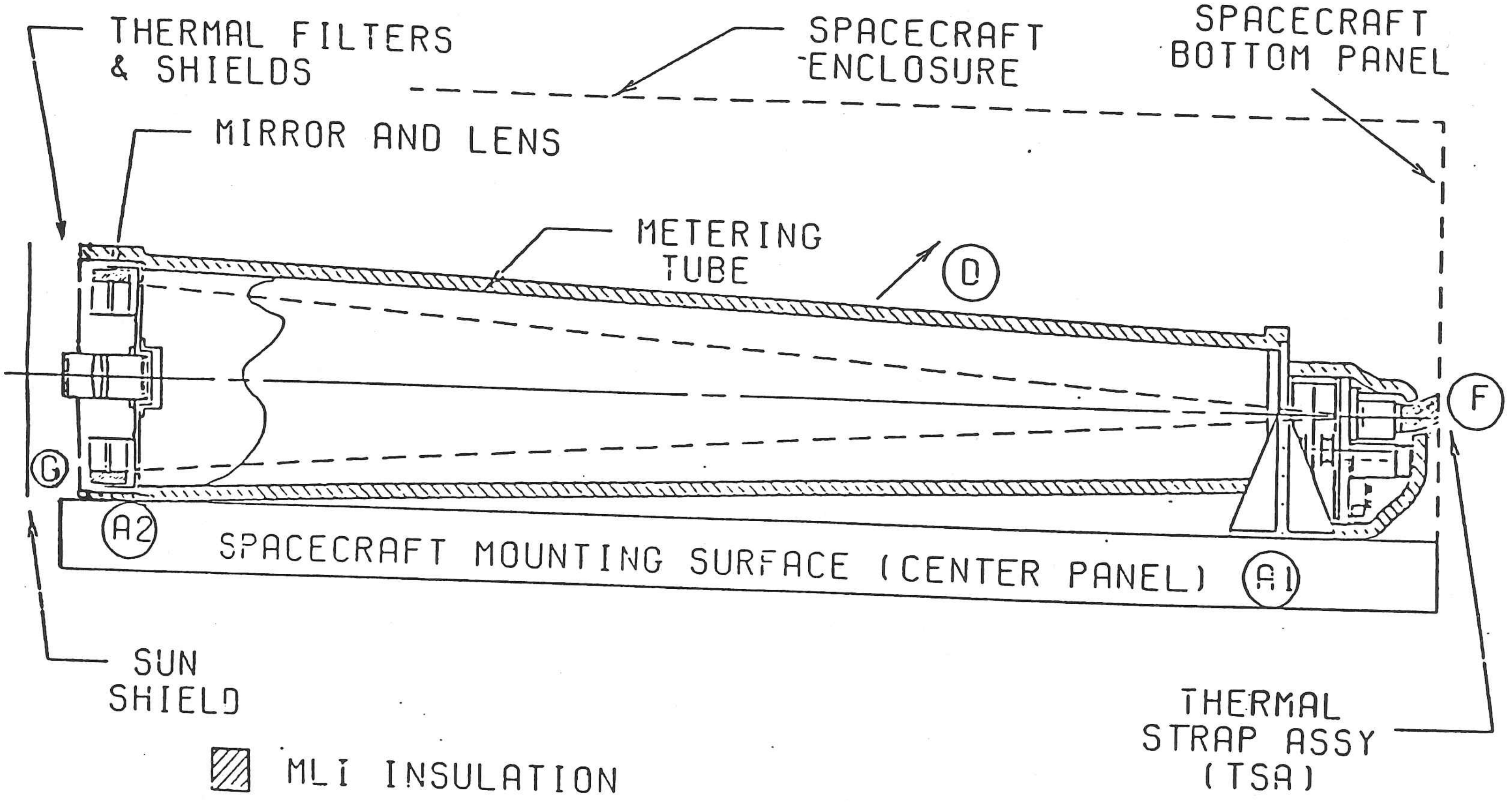
Table G.3-3
SXT Power Dissipation (watts)

COMPONENT	DAY		NIGHT	
	Max	Min	Max	Min
SXTS - FPG				
Absorbed Heat	--	--	--	--
Filter Motor	1.63 (1)	0.05	0.00	0.00
Shutter Motor	0.04	0.00	0.00	0.00
TEC Cold End	-0.78	-0.50	-0.78	-0.50
CCD Pre-Amp	0.40	0.40	0.00	0.00
TOTAL	1.29	-0.05	-0.78	-0.50
TEC Hot End	3.36 (2)	2.24 (3)	3.36	2.24
SXTS-Optics				
Aspect Motor	0.02	0.00	0.00	0.00
SXT Boxes				
FDE	0.48	0.42	0.00	0.00
SXTE-U	1.00	1.00	1.00	1.00
CCDP	2.41	1.93	2.46	0.00
CCDE	3.21	1.99	0.00	0.00

(1) FDE Motor Total = 1.56W (@28V) + 0.07W (@5V) = 1.63W
(2) From TEC Test Data:
Delta T = 40 C at 0.78W load requires 2.58W
Therefore Q H.E = 2.58W + 0.78W = 3.36W
(3) From TEC Test Data:
Delta T = 40 C at 0.50W load requires 1.74W
Therefore Q H.E = 1.74W + 0.50W = 2.24W

A diagram of the SXT instrument with thermal interface points called out is shown in Figure G.3-1.

FIGURE G.3-1 SXT THERMAL INTERFACE DRAWING



INTERFACE		AVERAGE THERMAL POWER (watts) (Avg. over 24 hour day.)
A2	Forward mounts	0.5
A1	Aft mounts	0.3
F	TEC thermal strap (TSA)	3.7
D	MLI ($e^* > 0.05$)	1.5
G	Front End / Spacecraft I/F	1.0

G.4 Thermal Design -

The CCD camera is cooled using a Thermal Electric Cooler (TEC) while the front and rear of the SXT instrument are controlled with feedback control heaters.

The cooling of the CCD is achieved by a 3-stage TEC. The TEC will be able to maintain a temperature differential between the hot and cold ends of 40 C for an input power of approximately 2.0 W and a hot end temperature of 20 C. The TEC is thermally connected to the back panel of the spacecraft with a Thermal Strap Assembly (TSA). The thermal resistance of the TSA is 2.81 C/W. Therefore, for a 2.58 W power dissipation and 0.78 W TEC heat sink outflow, the temperature differential between the spacecraft and the TEC will be 9.44 C. Since the desired operating temperature of the CCD is -20 C, the maximum temperature of the spacecraft back panel at the TEC interface is approximately 10.6 C.

The TEC TSA consists of two copper braids (each braid is made from 1640 30 AWG copper wires) in parallel. Each end of the braid is soldered to one of two copper capture blocks. A thin piece of aluminum is bonded to the aft capture block with high temperature epoxy (3M EC2216 or equivalent) and then the capture block is bolted to the spacecraft back panel.

There will be a resistor-type heater mounted on the capture block attached to the CCD. This will provide enough heat (approximately 8W) for on-orbit bake-out of the CCD.

The exterior surfaces will be covered with either Teflon/Aluminum tape, Aluminum/Kapton tape or a 20-layer thermal insulation blanket. The Multi-Layer Insulation (MLI) consists of layers of an embossed aluminized Kapton film with no dielectric spacer. The inner and outer layers are Aluminized/Kapton-Fiberglass cloth, and all blankets are electrically grounded. This high thermal impedance blanket isolates the instrument from high radiative heat loads from the spacecraft. The primary heat rejection path will be by conduction through the rear mount to the spacecraft.

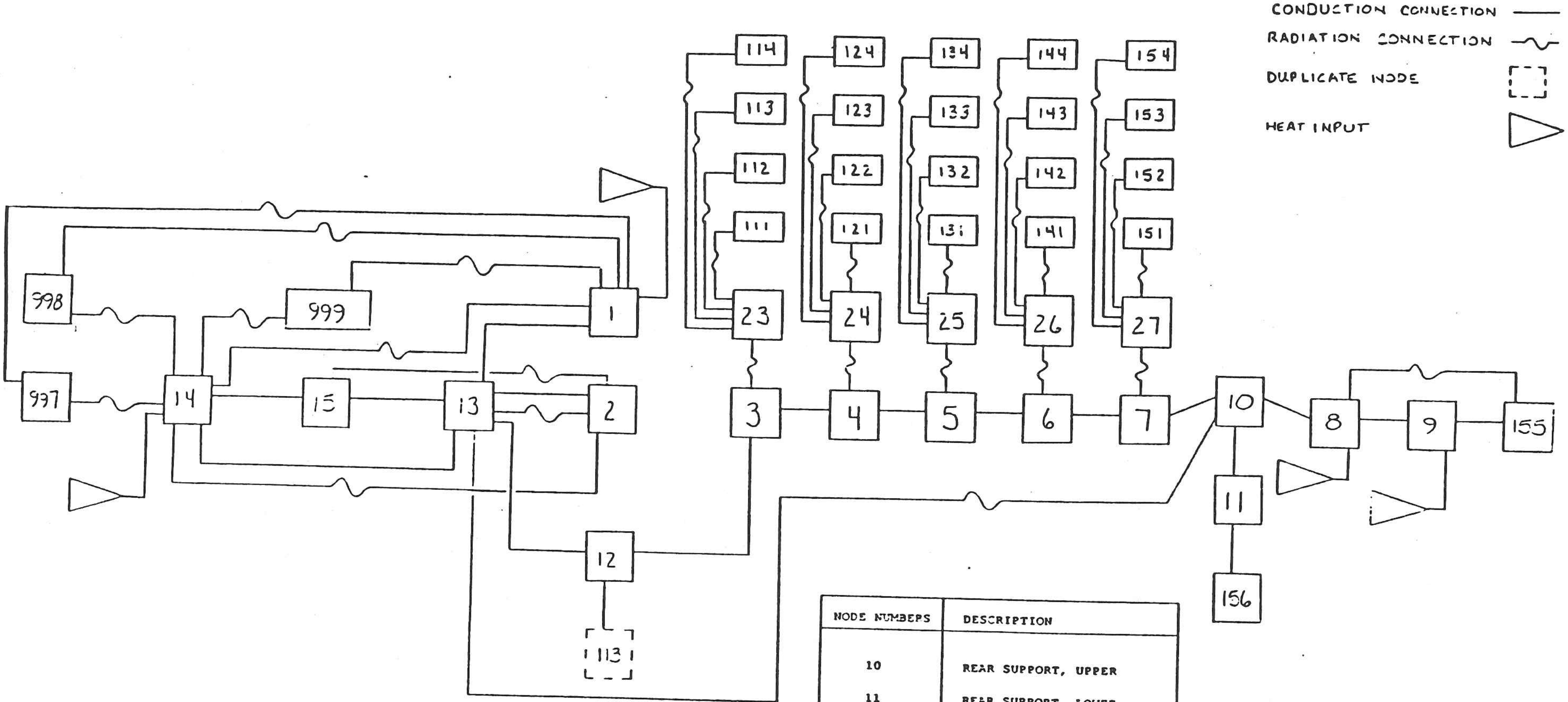
There is a Japanese provided spacecraft mounted sun-shield with an interior surface painted black. (Reference Fig. 3.5-1 of EICA)

G.5 Reduced Thermal Math Model Description -

The Reduced Thermal Math Model (RTMM) is described in the following section.

The nodal layout with conduction and radiation resistors is presented in Figure G.5-1. Node 999 represents deep space, node 998 represents the front of the spacecraft, and node 997 represents the sun shield, nodes 1xx represent the remainder of the spacecraft, and all other nodes represent the SXT instrument. Figures G.5-2 through G.5-6 show the physical correspondence of the RTMM nodes. These drawings are for information only and should not be used for design or measurement purposes.

SXT NODAL LAYOUT



NODE NUMBERS	DESCRIPTION
1	ASPECT SENSOR (LENSES)
2	MIRROR
3 - 7	METERING TUBE
8	FILTER WHEEL HOUSING
9	TEC HOT END

NODE NUMBERS	DESCRIPTION
10	REAR SUPPORT, UPPER
11	REAR SUPPORT, LOWER
12	FRONT SUPPORT
13	FRONT SUPPORT PLATE
14	FRONT END/APERTURE
15	OUTER HOUSING RING
23 - 27	TUBE MLI
1XX	SPACECRAFT
997	SUN SHIELD
998	SPACECRAFT FRONT
999	SPACE

FIGURE G.5-1 SXT RTMM NODAL LAYOUT

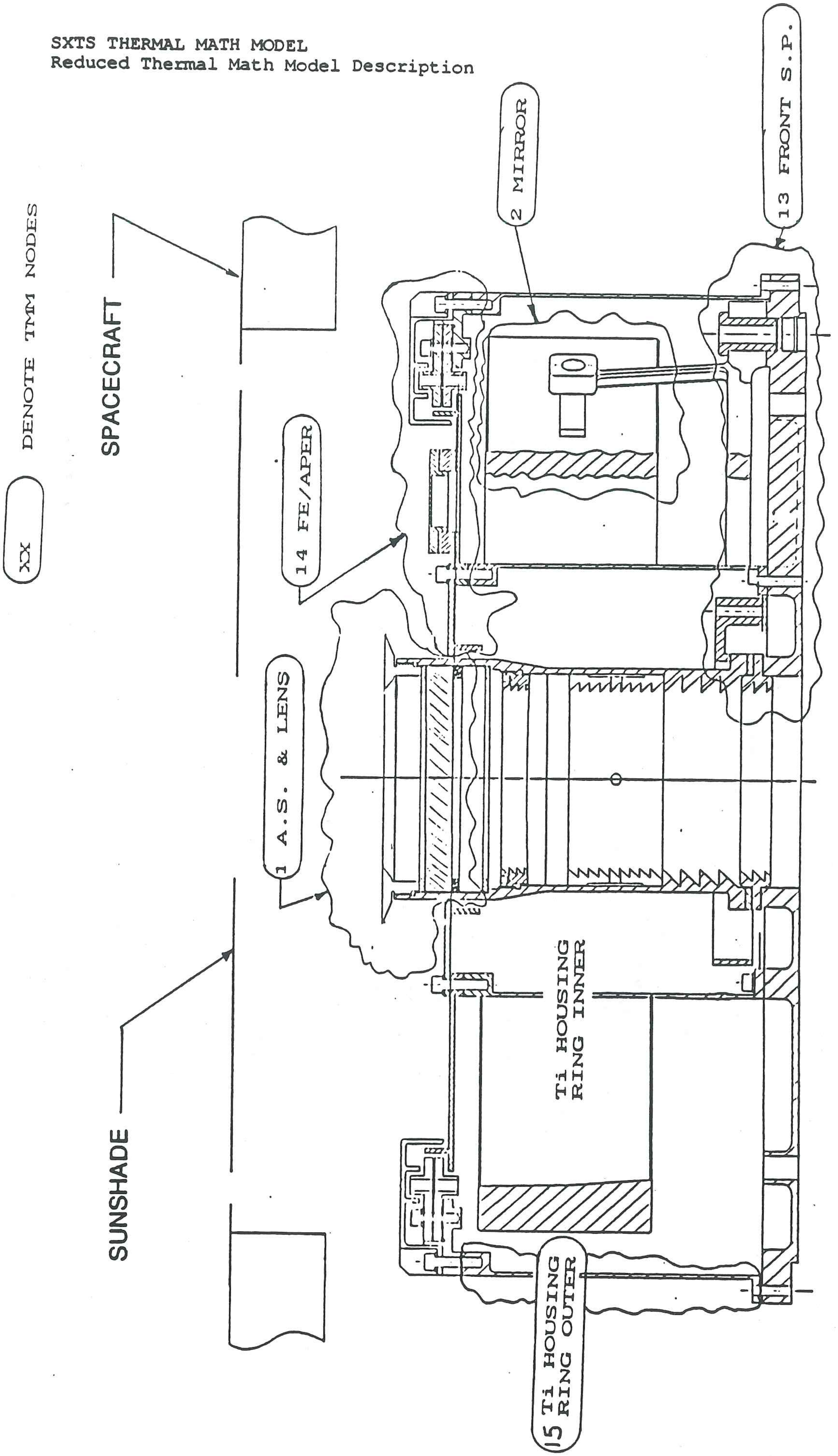


FIGURE G.5-2 SXT FRONT END NODE IDENTIFICATION

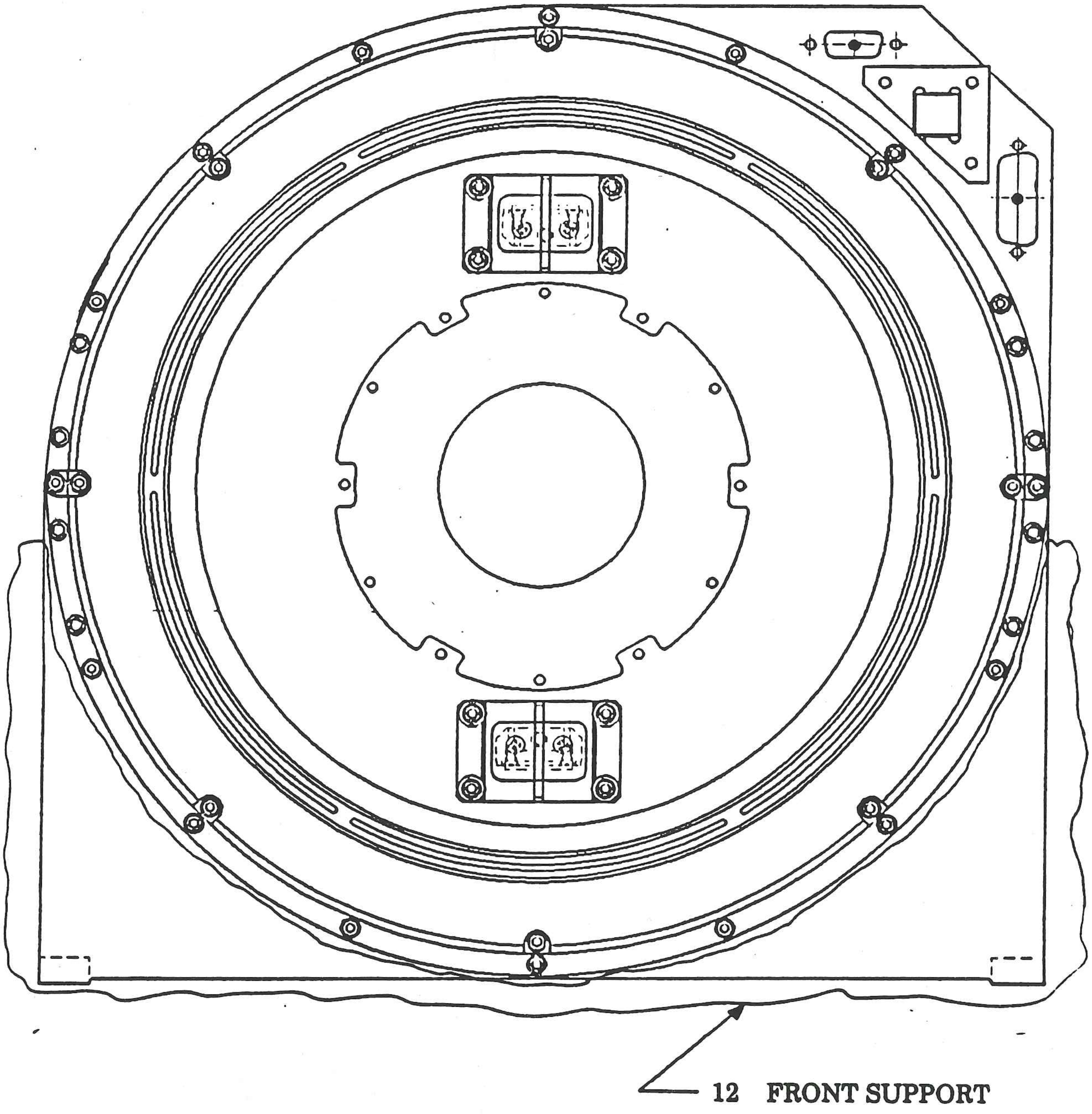


FIGURE G.5-3 SXT FRONT SUPPORT NODE IDENTIFICATION

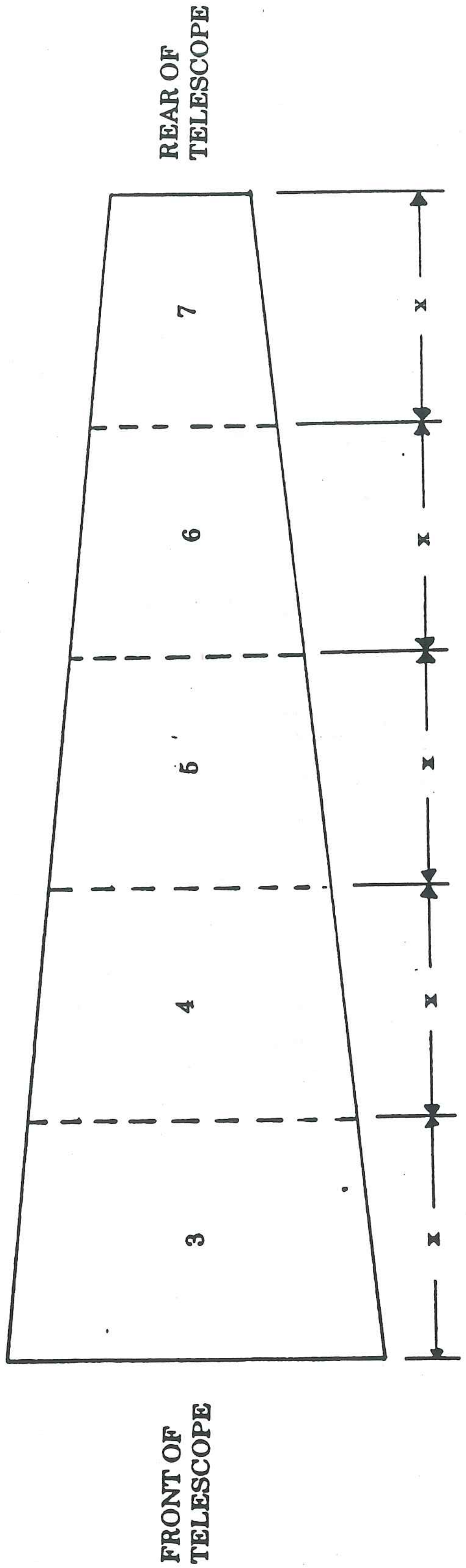


FIGURE G.5-4 SXT METERING TUBE NODE IDENTIFICATION

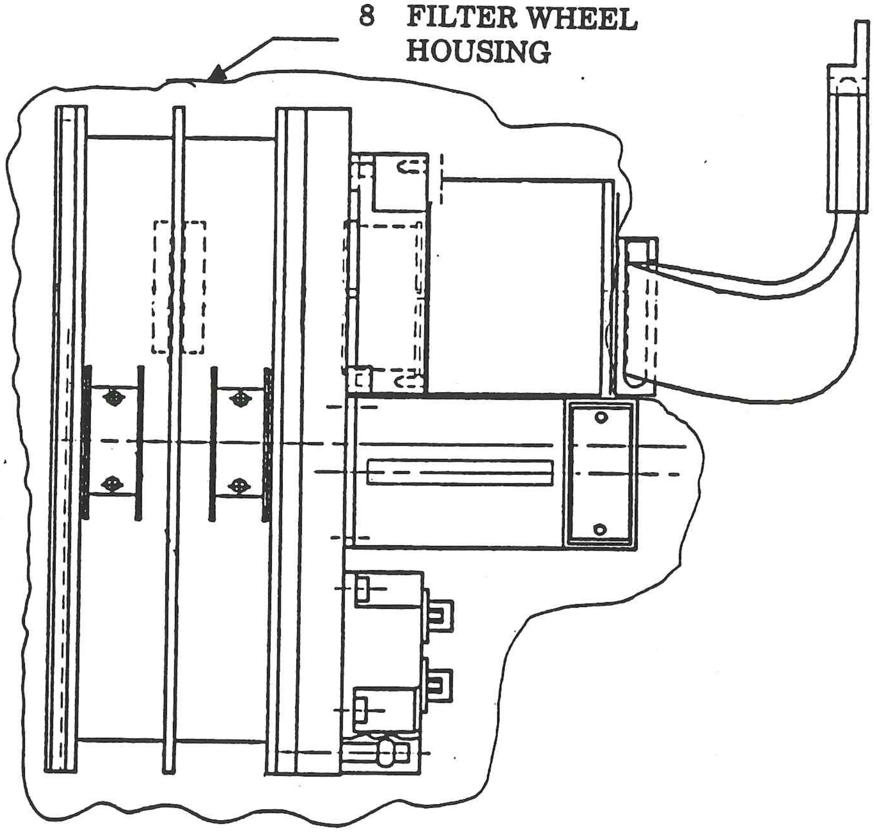


FIGURE G.5-5 SXT FOCAL PLANE GROUP NODE IDENTIFICATION

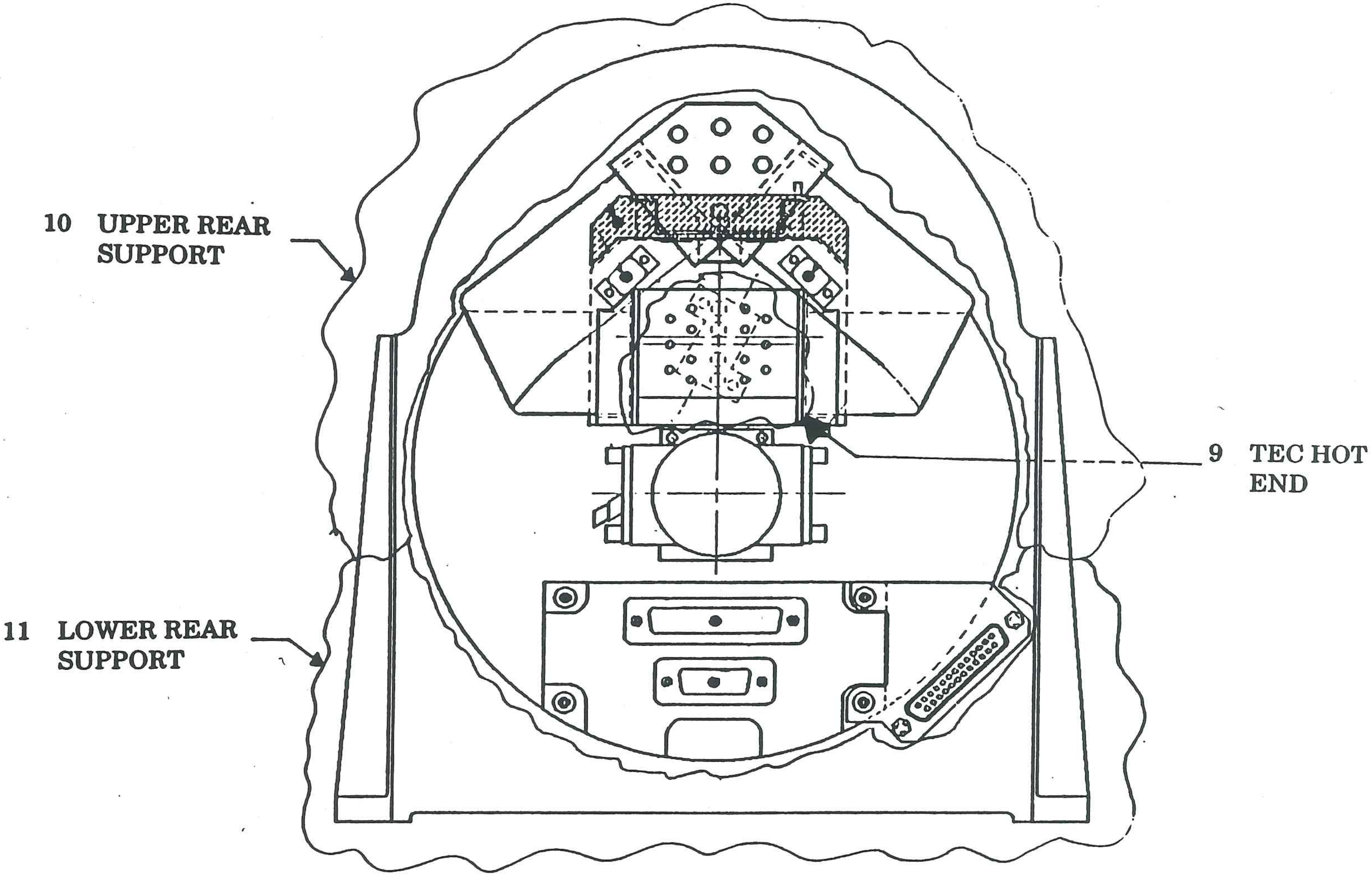


FIGURE G.5-6 SXT BACK END NODE IDENTIFICATION

Tables G.5-1 and G.5-2 give the values of the conduction and radiation resistors respectively. The units are cgs throughout, C/W and cm^2 unless noted. It will be noted that five external MLI nodes (23 through 27) have been added in order to facilitate the modeling of the SXTS external surface with the spacecraft interior. These nodes are virtual nodes with zero heat capacity. Each of these nodes represents an area of 1754 cm square, with an hemispherical emissivity of 0.05.

The conduction resistors through the tube (nodes 3 - 7) were calculated using a conductivity value of 0.83 W/cm-K measured at LPARL and assuming a tapered tube. A piece of the EM tube was used to measure the thermal conductivity.

Table G.5-1
SXT Conduction Resistors (DEG C/W)

RESISTOR NUMBER	NODE	NODE	VALUE C/W	DESCRIPTION
01	01	13	5.63	LENS TO FRONT SUPP PLATE
02	02	13	4.36	MIRROR TO FRONT SUPP PLATE
03	13	14	115.63	FRONT SUPP PL TO FRONT END/AP
04	13	12	0.08	FRONT SUPP PLATE TO SUPP
05	12	03	1.51	FRONT SUPP TO TUBE
06	12	113	117.21	SUPP TO S/C
07	03	04	2.83	AXIAL TUBE
08	04	05	3.13	" "
09	05	06	3.50	" "
10	06	07	6.20	AXIAL TUBE
11	07	10	1.99	TUBE TO UPPER SUPPORT
12	10	08	0.08[0.01]*	UPPER SUPP TO FOCAL PLANE
13	08	09	226.50	FWH TO TEC
14	09	155	3.09	TEC TO S/C
15	10	11	1.40	UPPER SUPP TO LOWER SUPP
16	11	156	1.53	LOWER SUPP TO S/C
17	14	15	101.00	FRONT END TO OUTER HSG
18	15	13	101.00	OUTER HSG TO FR SUPP PL

* These values apply to the ST model.

Table G.5-2
SXT Radiation K's (cm^2)

RADIATION K NUMBER	NODE	NODE	VALUE CM^2	DESCRIPTION
01	01	999	13.83	LENS TO SPACE
02	01	998	14.49	LENS TO S/C
03	14	999	66.94	FRONT END/AP TO SPACE
04	23	111	21.93	TUBE MLI TO S/C
05	23	112	21.93	TUBE MLI TO S/C
06	23	113	21.93	TUBE MLI TO S/C
07	23	114	21.93	TUBE MLI TO S/C
08	24	121	21.93	TUBE MLI TO S/C
09	24	122	21.93	TUBE MLI TO S/C
10	24	123	21.93	TUBE MLI TO S/C
11	24	124	21.93	TUBE MLI TO S/C
12	25	131	21.93	TUBE MLI TO S/C
13	25	132	21.93	TUBE MLI TO S/C
14	25	133	21.93	TUBE MLI TO S/C
15	25	134	21.93	TUBE MLI TO S/C
16	26	141	21.93	TUBE MLI TO S/C
17	26	142	21.93	TUBE MLI TO S/C
18	26	143	21.93	TUBE MLI TO S/C
19	26	144	21.93	TUBE MLI TO S/C
20	27	151	21.93	TUBE MLI TO S/C
21	27	152	21.93	TUBE MLI TO S/C
22	27	153	21.93	TUBE MLI TO S/C
23	27	154	21.93	TUBE MLI TO S/C
24	08	155	88.39	FWH TO S/C
25	14	997	185.13	FRONT END/AP TO SUNSHIELD
26	03	23	41.76	TUBE TO TUBE MLI
27	04	24	41.76	
28	05	25	41.76	
29	06	26	41.76	
30	07	27	41.76	TUBE TO TUBE MLI
31	14	998	161.90	FRONT END TO S/C
32	01	997	32.76	LENS TO SUNSHIELD
33	01	14	20.35	LENS TO FRONT END
35	14	02	62.58	FRONT END TO MIRROR
36	13	02	62.58	FRONT SUPP PL TO MIRROR
37	13	10	13.32	FR SUPP PL TO UPP REAR SUPP
38	15	02	237.18	OUTER HOUSING TO MIRROR
39	14	13	4.80	FR END/AP TO FR SUPP PL

The capacitance values are presented in Table G.5-3.

Table G.5-3
SXT Capacitors (J/DEG C)

NODE NUMBER	VALUE J/DEG C		DESCRIPTION
01	310.00		ASPECT SENSOR LENSES
02	325.00	[1549]*	MIRROR
03	103.18		METERING TUBE
04	103.18		
05	103.18		
06	103.18		
07	103.18		METERING TUBE
08	1634.38	[3270]*	FILTER WHEEL HOUSING
09	341.38		TEC HOT END
10	908.18		REAR SUPPORT,UPPER
11	672.14		REAR SUPPORT,LOWER
12	317.00		FRONT END/SUPPORT
13	686.00		FRONT SUPPORT PLATE
14	787.00		FRONT END/APERTURE
15	252.00		OUTER HOUSING
--	2026.32		CCDE/P
--	1650.53		FDE
--	5595.00		SXTE-U

*These values apply to the ST Model.

The dissipated heat rates and the absorbed heat rates are presented in Table G.5-4 for the hot orbit condition and for the cold orbit condition.

Table G.5-4a
SXT Heat Rates (W), WCC

NODE	SOLAR	ALBEDO	EARTH	I(2)R	TOTAL	HTR PWR	DESCRIPTION
01	0.21	0.00	0.02	0.00		--	A.S.L. & SHUTTER
01	0.09	0.00	0.08	0.00		--	LENS SURROUNDINGS
01					0.41		TOTAL INTO NODE 01
08	0.00	0.00	0.00	-0.50	-0.50	8.0	FILTER WHEEL GROUP
09	0.00	0.00	0.00	2.24	2.24	--	TEC HOT END
14	1.04	0.00	0.47	0.00		3.5	FRONT END
14	0.15	0.00	0.00	0.00		--	APERTURE
14					1.67		TOTAL INTO NODE 14

Table G.5-4b
SXT Heat Rates (W), WCH

NODE	SOLAR	ALBEDO	EARTH	I(2)R	TOTAL	HTR PWR	DESCRIPTION
01	0.40	0.00	0.02	0.02		--	A.S.L. & SHUTTER
01	0.17	0.00	0.06	0.00		--	LENS SURROUNDINGS
01					0.67		TOTAL INTO NODE 01
08	0.00	0.00	0.00	1.29	1.29	8.0	FILTER WHEEL GROUP
09	0.00	0.00	0.00	3.36	3.36	--	TEC HOT END
14	1.92	0.01	0.38	0.00		3.5	FRONT END
14	0.20	0.00	0.00	0.00		--	APERTURE
14					2.51		TOTAL INTO NODE 14

The following table contains orbit information used for the Worst Case Hot (WCH) and Worst Case Cold (WCC) calculations.

Table G.5-5
Orbit Assumptions

PARAMETER	WCC	WCH
Solar Flux, W/cm(2)	0.132	0.142
Albedo Factor	0.30	0.30
Earth Temperature, Deg K	248	248
Eclipse Factor	0.36	0.25
Beta Angle	0	55

G.6 Results -

The following section contains the steady state results from the RTMM. Table G.6-1 lists all nodes and their respective temperatures for heater failure mode. For WCC, the heaters were failed off. For WCH, the heaters were failed on. Figures G.6-1 through G.6-16 show the nominal orbit transients.

Table G.6-1a
SXT Temperatures (C), WCC

NODE	TEMPERATURE	NODE	TEMPERATURE	NODE	TEMPERATURE
01	0.28	02	0.35	03	0.60
04	0.44	05	-0.15	06	-1.27
07	-4.03	08	-5.08	09	-0.56
10	-5.03	11	-4.99	12	0.51
13	0.50	14	-4.03	15	0.28
23	6.38	24	6.93	25	6.47
26	5.09	27	-0.98	111	7.87
112	8.25	113	8.16	114	11.71
121	10.61	122	8.14	123	8.47
124	12.19	131	10.32	132	10.99
133	6.76	134	9.75	141	10.57
142	8.64	143	2.88	144	9.59
151	-1.40	152	2.44	153	-2.42
154	3.01	155	-7.42	156	-4.94
997	-2.40	998	5.81	999	-273.15

Table G.6-1b
SXT Temperatures (C), WCH

NODE	TEMPERATURE	NODE	TEMPERATURE	NODE	TEMPERATURE
01	22.07	02	23.04	03	21.71
04	21.13	05	20.66	06	20.37
07	20.46	08	21.60	09	3.87
10	20.96	11	10.17	12	22.11
13	22.13	14	28.42	15	23.32
23	19.26	24	18.82	25	17.85
26	16.28	27	9.85	111	17.49
112	18.06	113	17.29	114	19.41
121	18.62	122	16.71	123	15.88
124	19.56	131	17.88	132	18.02
133	13.08	134	16.86	141	17.60
142	15.19	143	7.89	144	16.08
151	2.72	152	6.39	153	0.89
154	7.29	155	-6.75	156	-1.62
997	15.29	998	17.41	999	-273.15

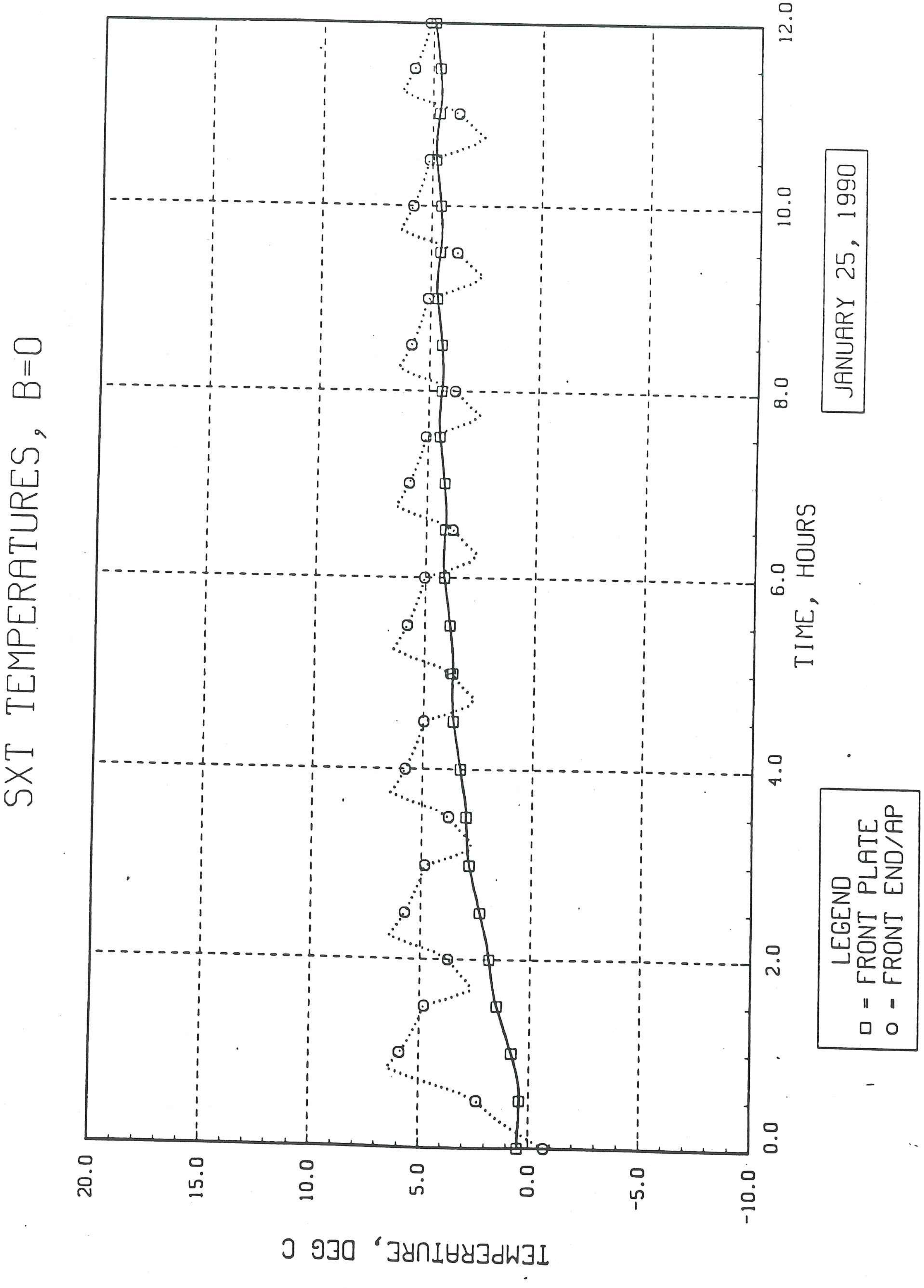


FIGURE G.6-1 SXT WCC TRANSIENT TEMPERATURES

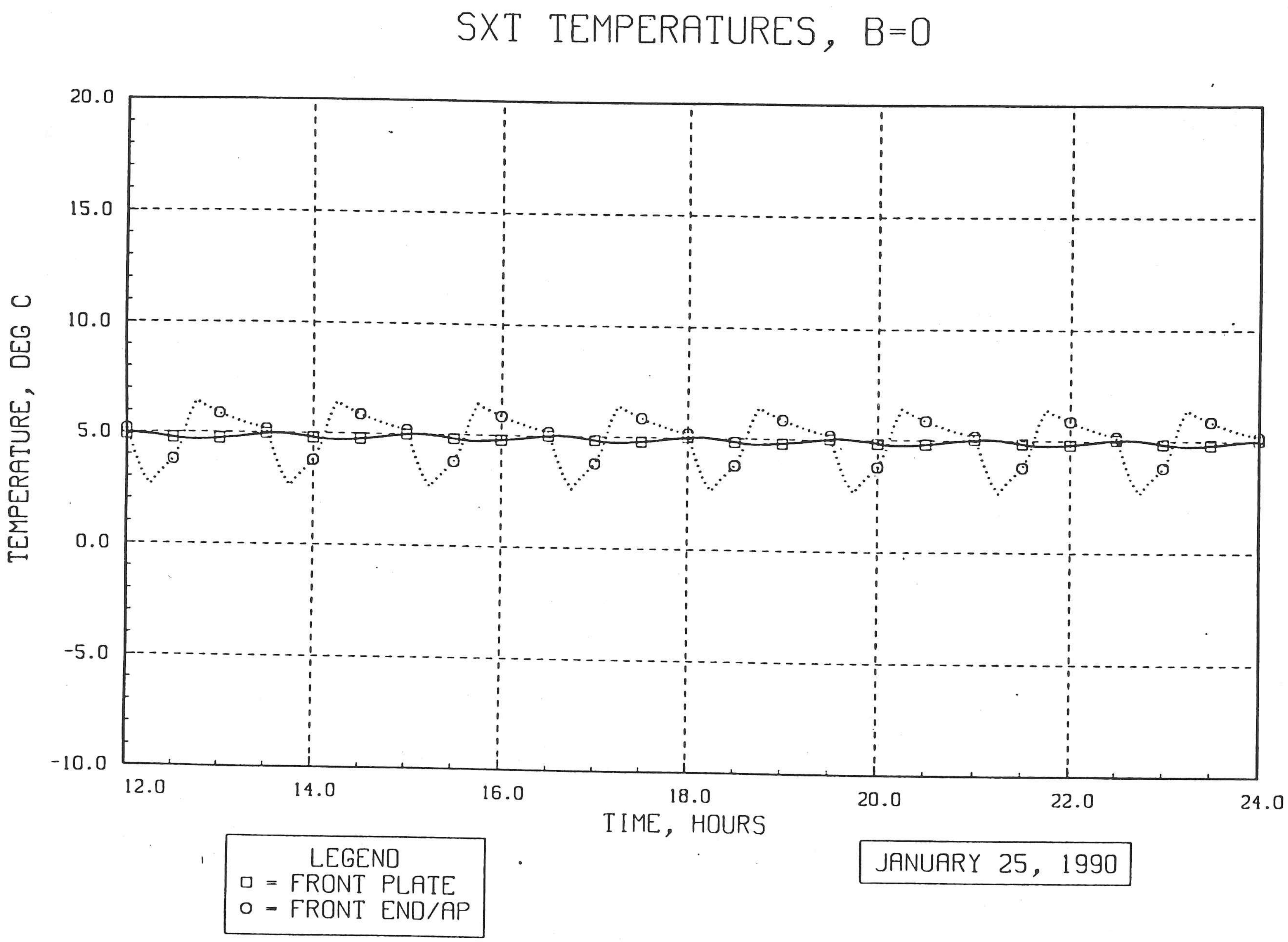


FIGURE G.6-2 SXT WCC TRANSIENT TEMPERATURES

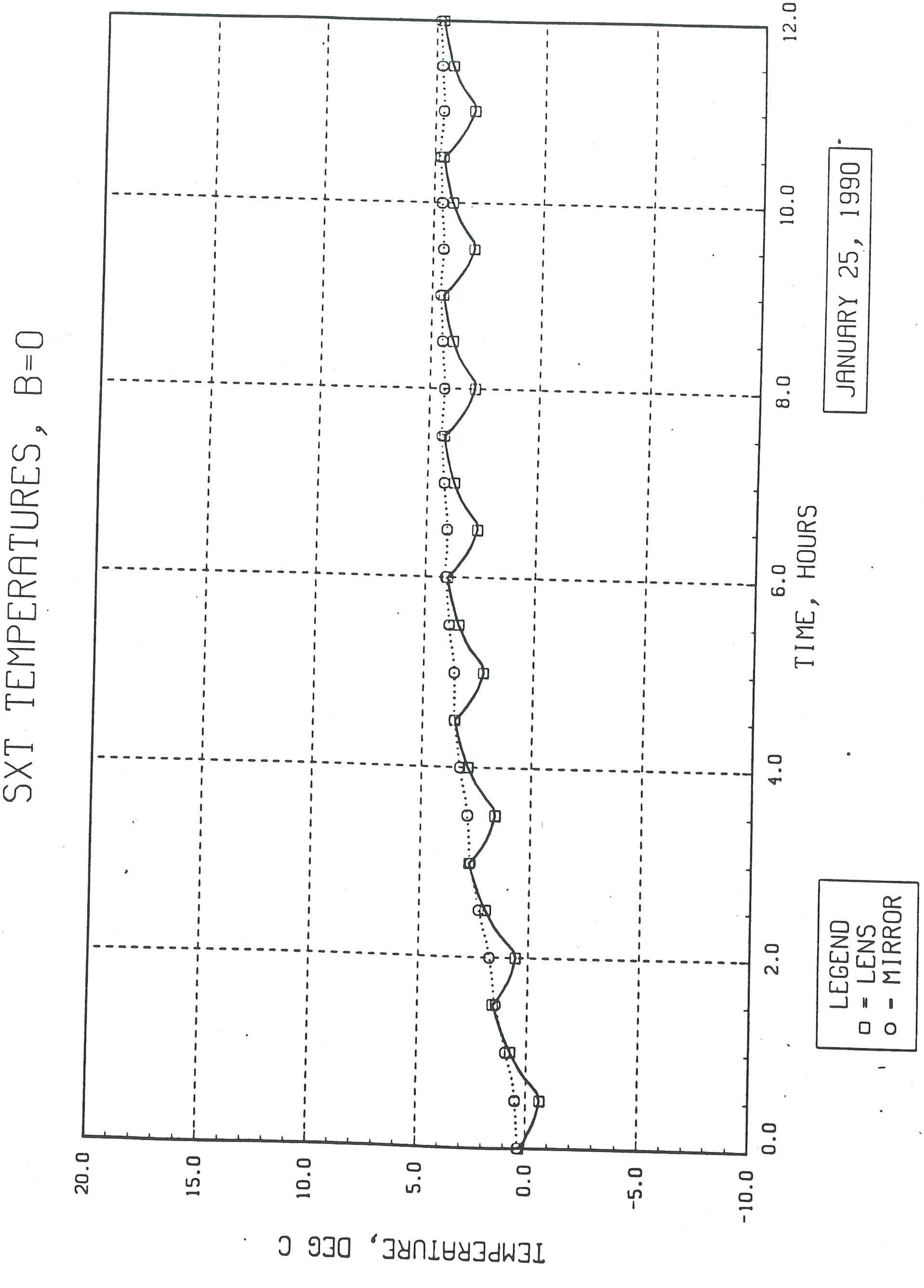


FIGURE G.6-3 SXT WCC TRANSIENT TEMPERATURES

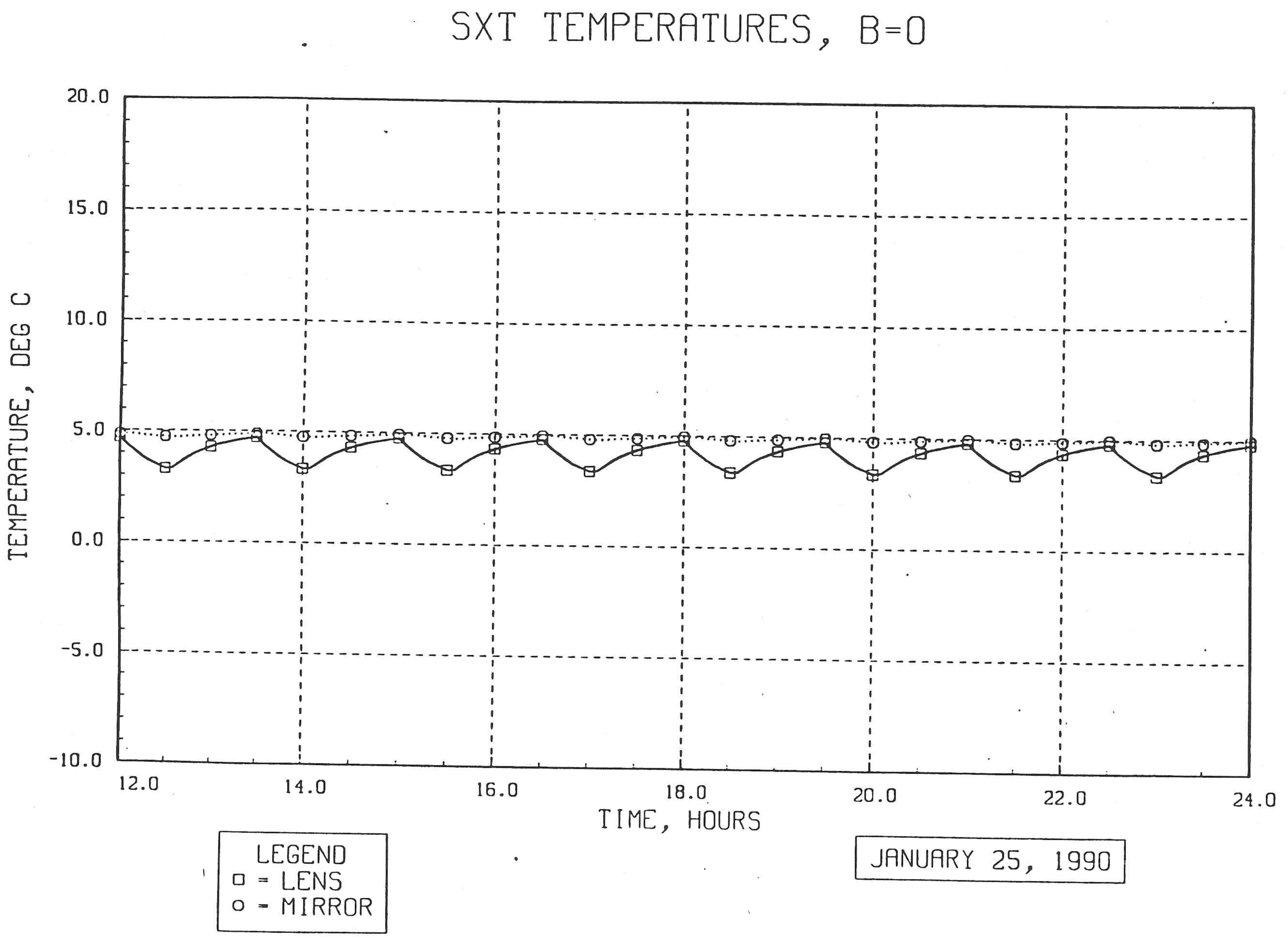


FIGURE G.6-4 SXT WCC TRANSIENT TEMPERATURES

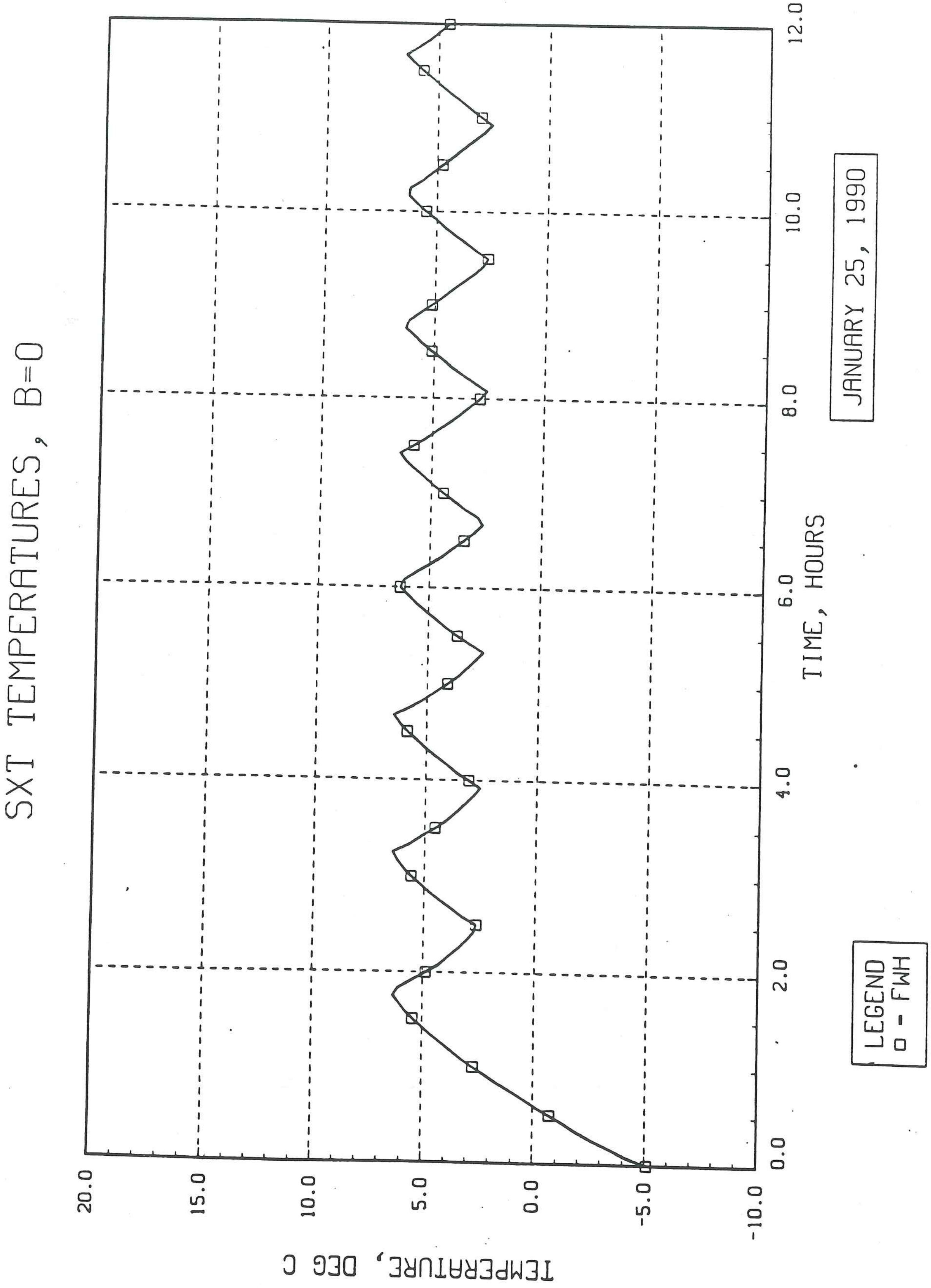


FIGURE G.6-5 SXT WCC TRANSIENT TEMPERATURES

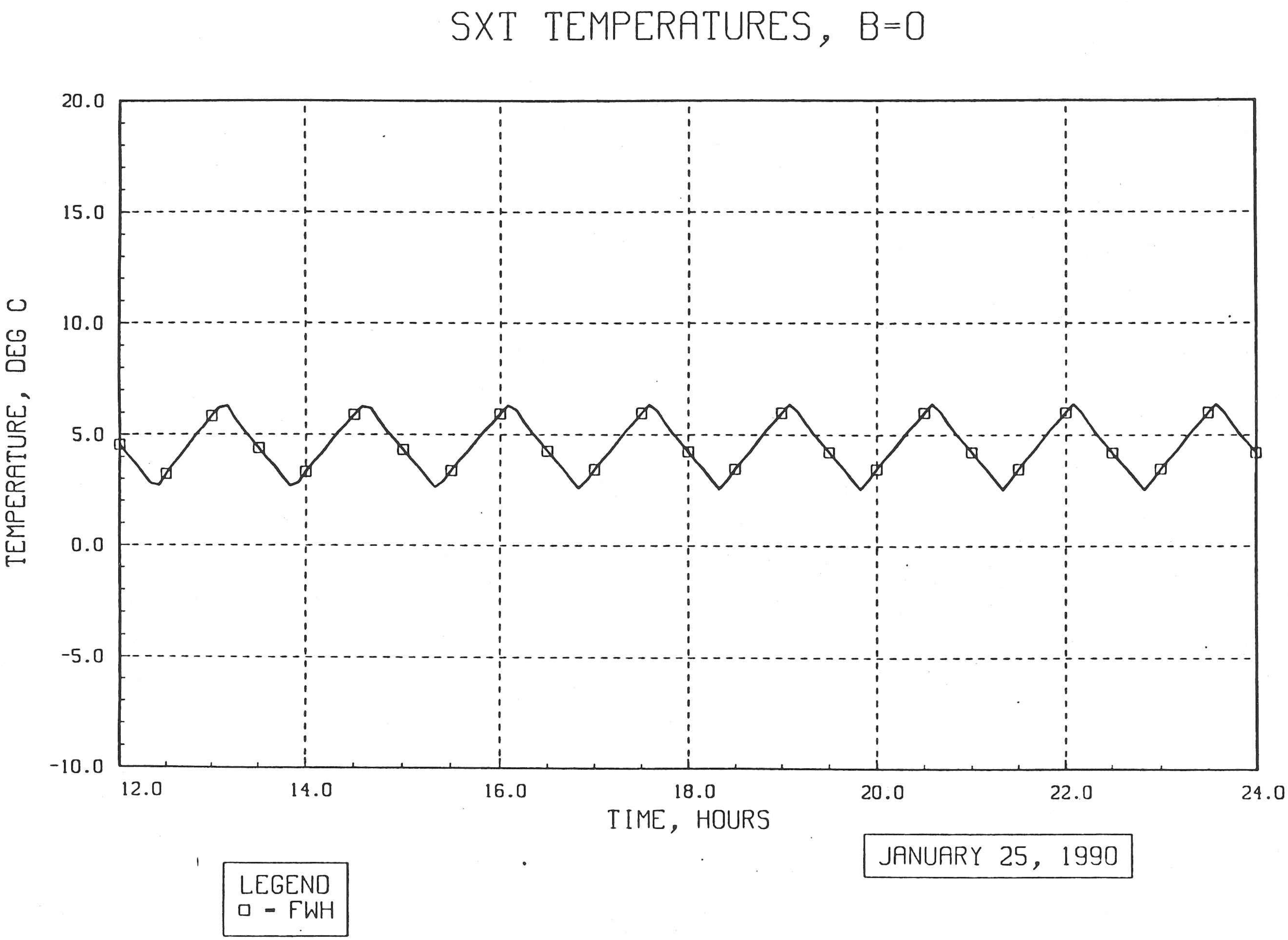


FIGURE G.6-6 SXT WCC TRANSIENT TEMPERATURES

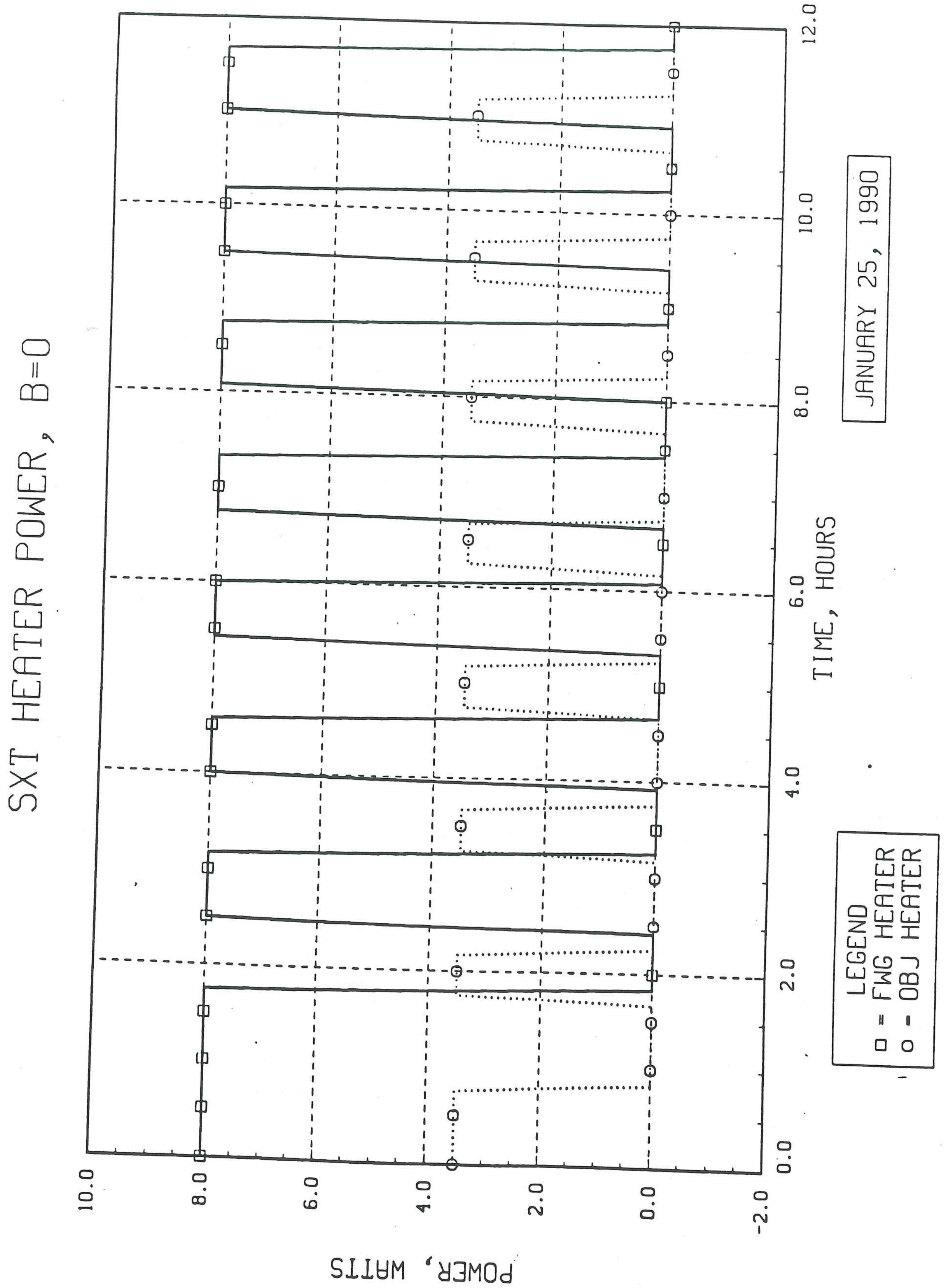


FIGURE G.6-7 SXT WCC TRANSIENT HEATER POWERS

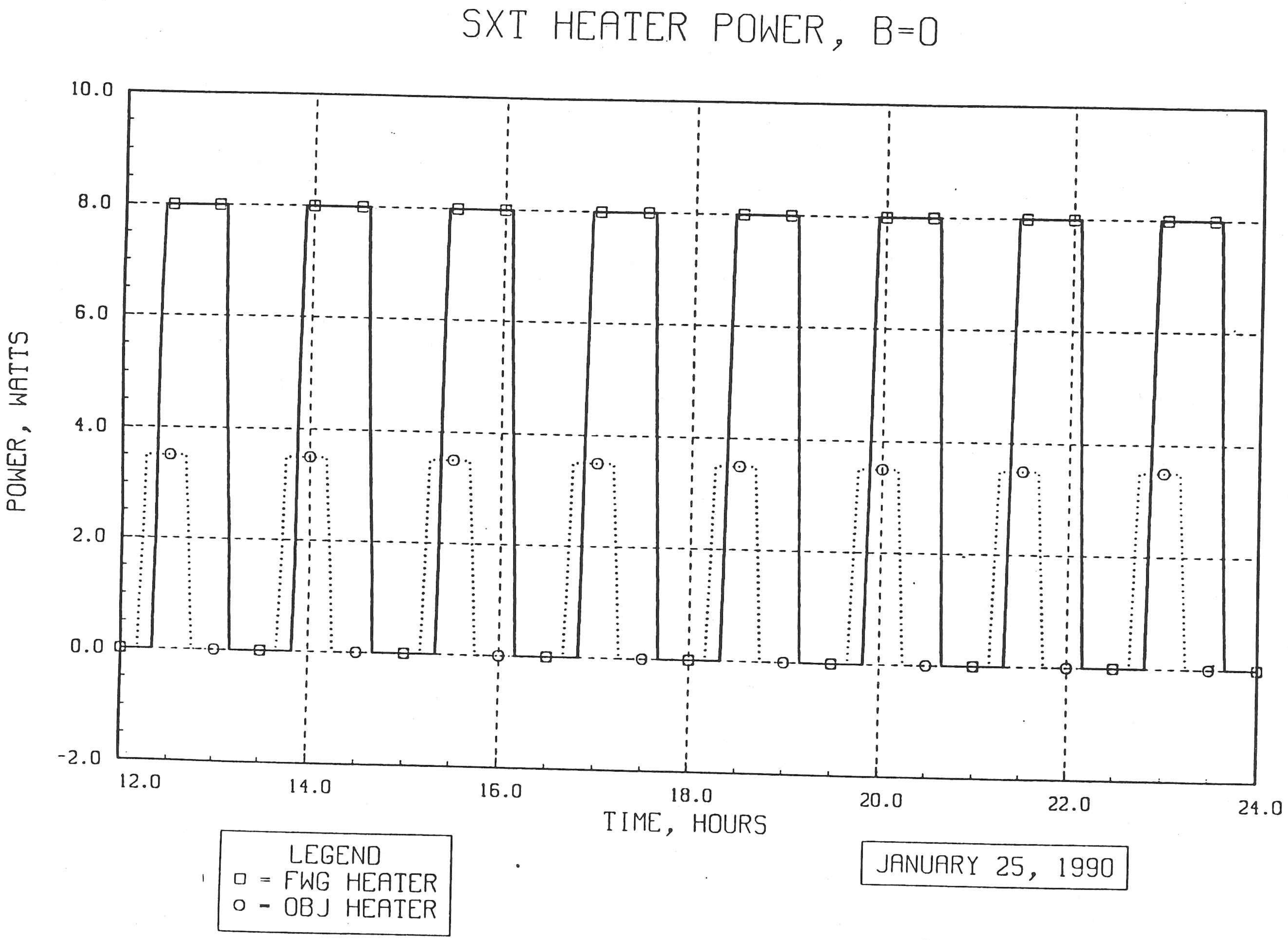


FIGURE G.6-8 SXT WCC TRANSIENT HEATER POWERS

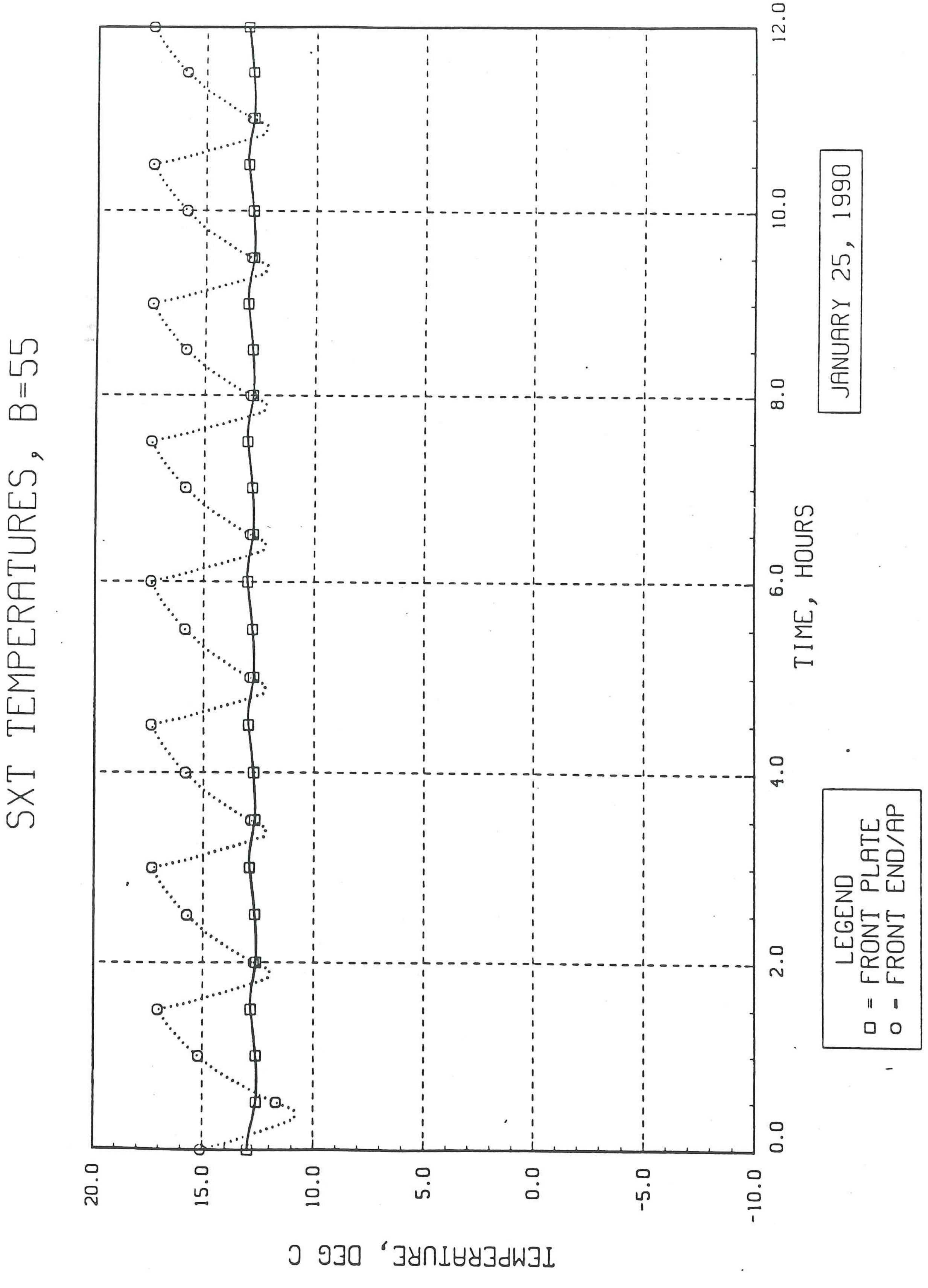


FIGURE G.6-9 SXT WCH TRANSIENT TEMPERATURES

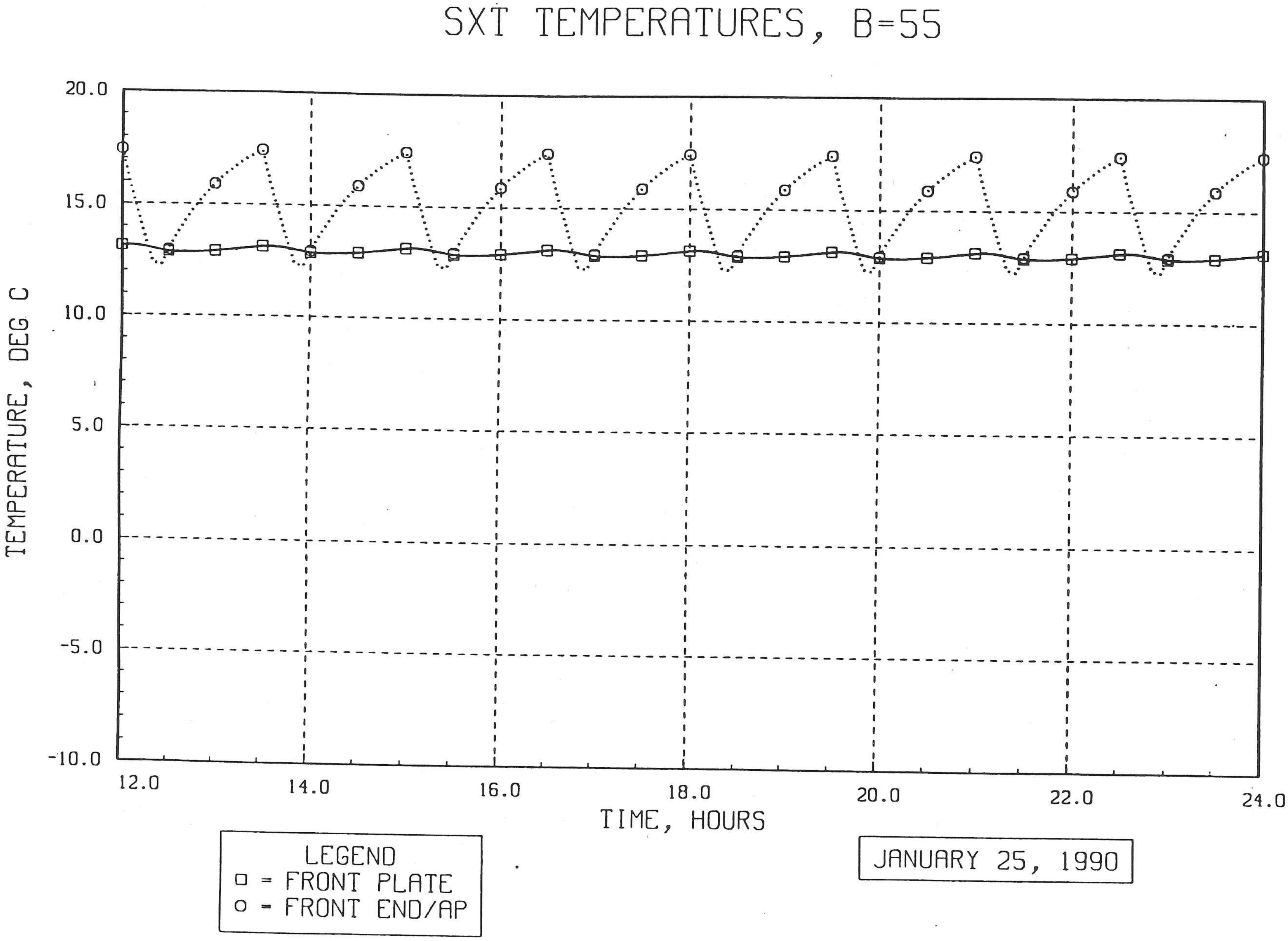


FIGURE G.6-10 SXT WCH TRANSIENT TEMPERATURES

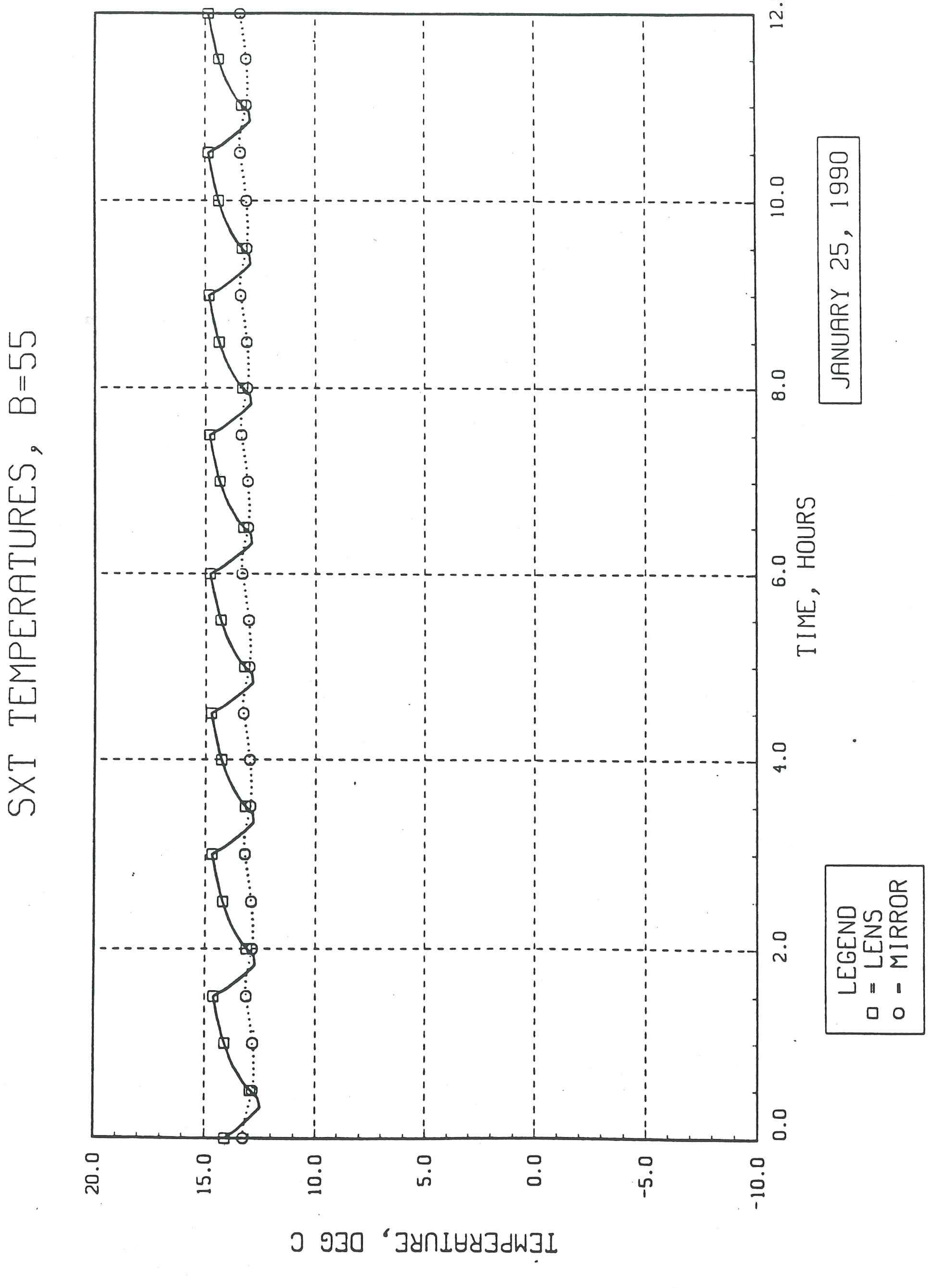


FIGURE G.6-11 SXT WCH TRANSIENT TEMPERATURES

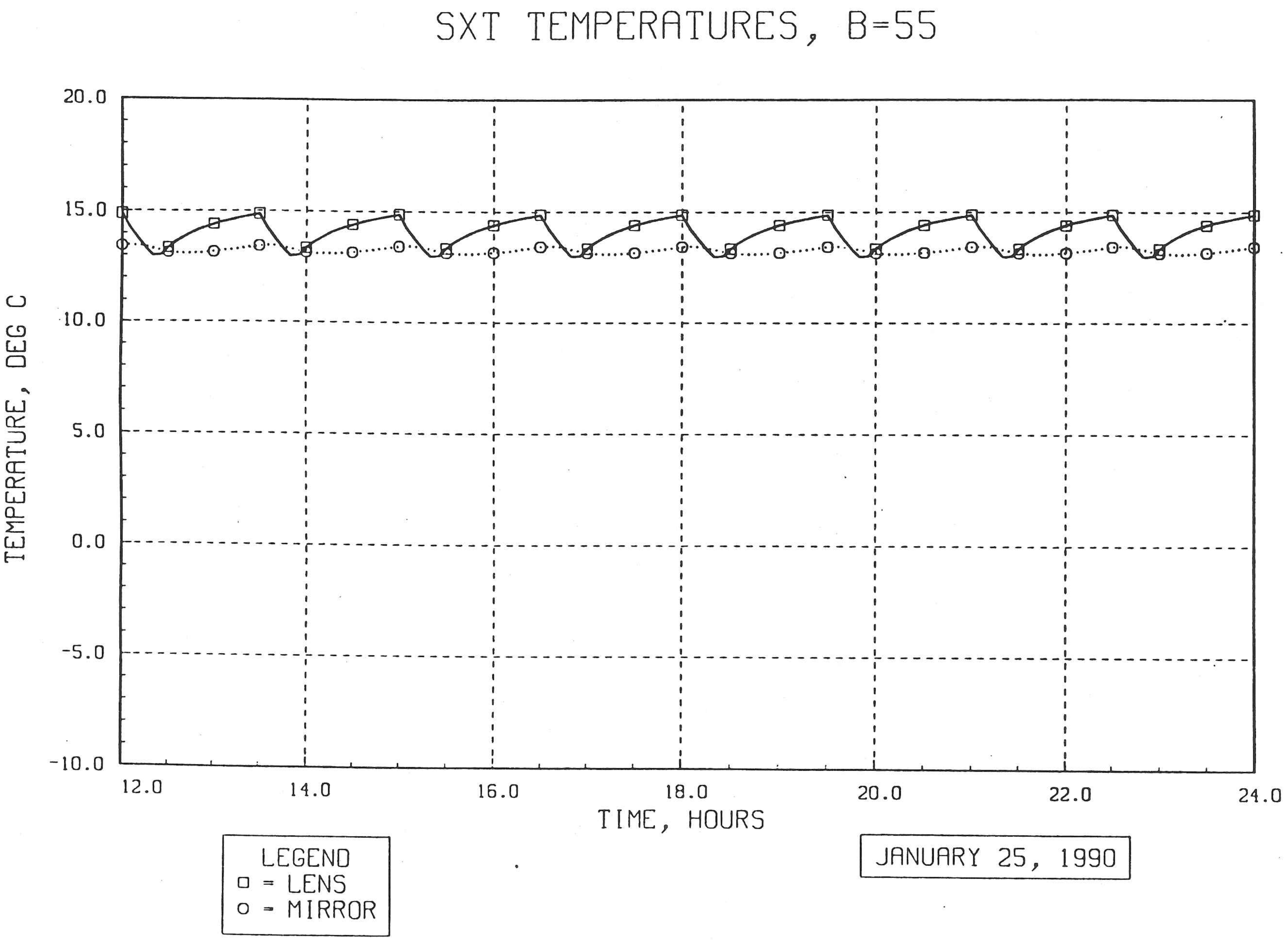


FIGURE G.6-12 SXT WCH TRANSIENT TEMPERATURES

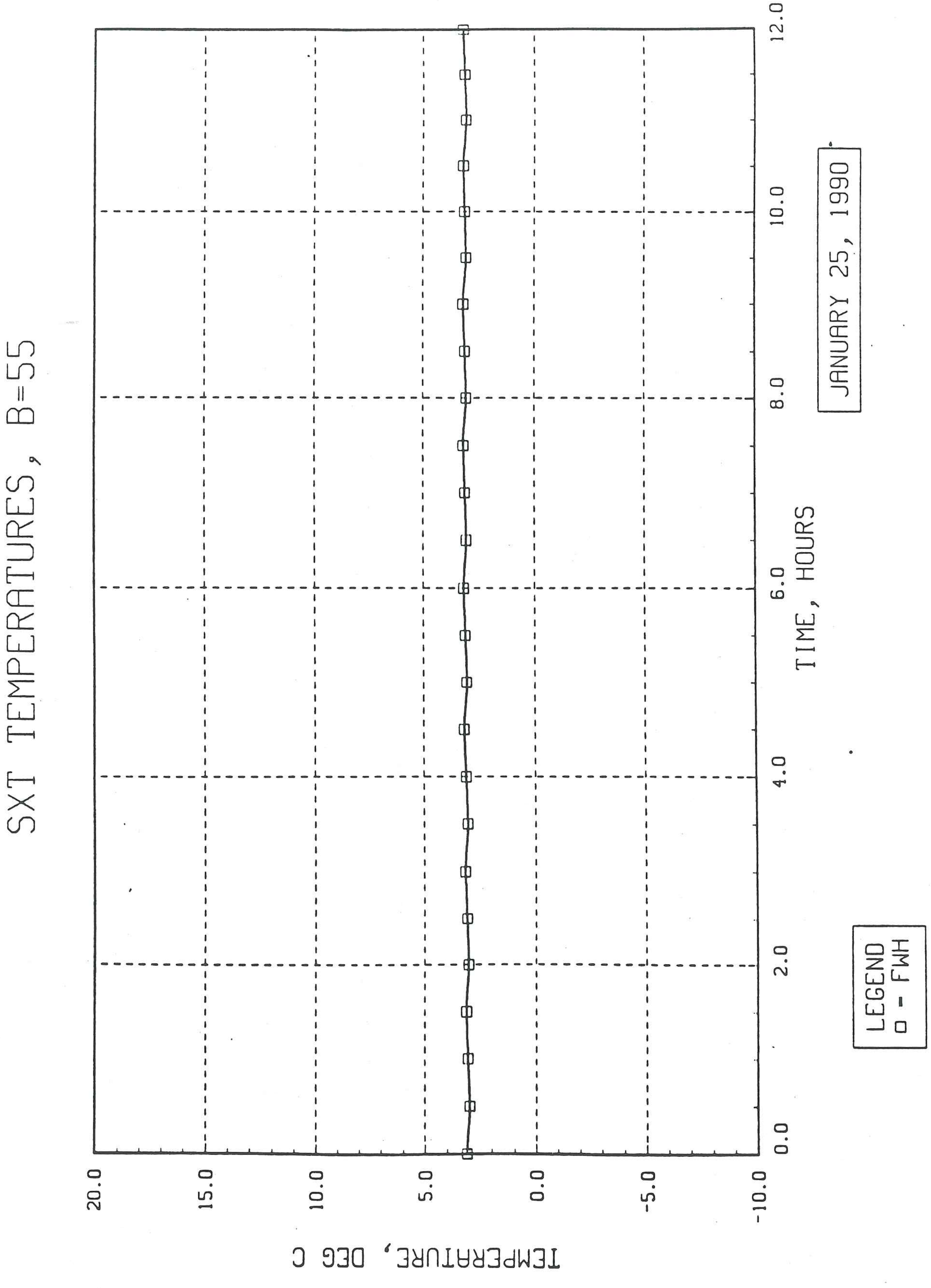


FIGURE G.6-13 SXT WCH TRANSIENT TEMPERATURES

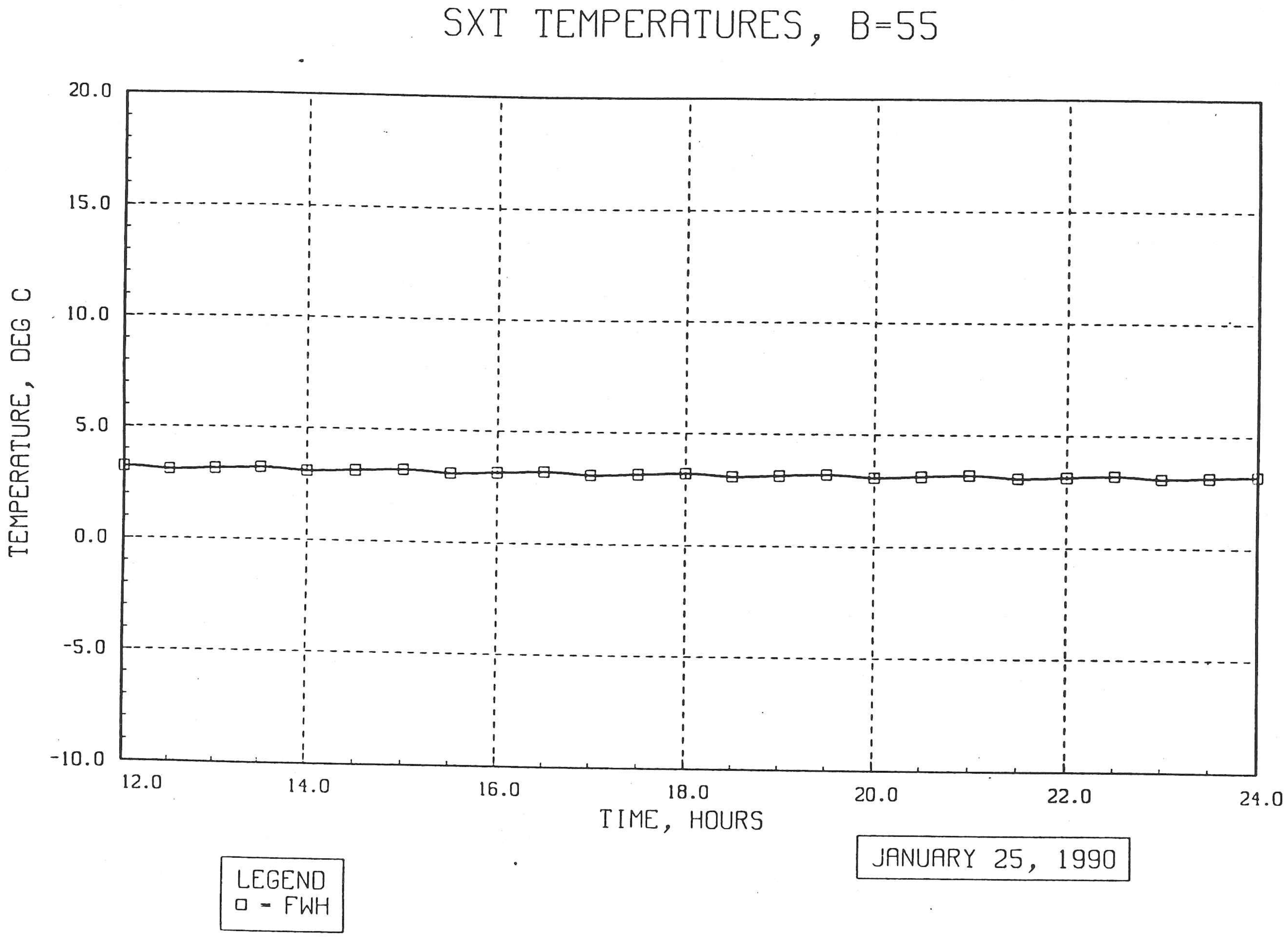


FIGURE G.6-14 SXT WCH TRANSIENT TEMPERATURES

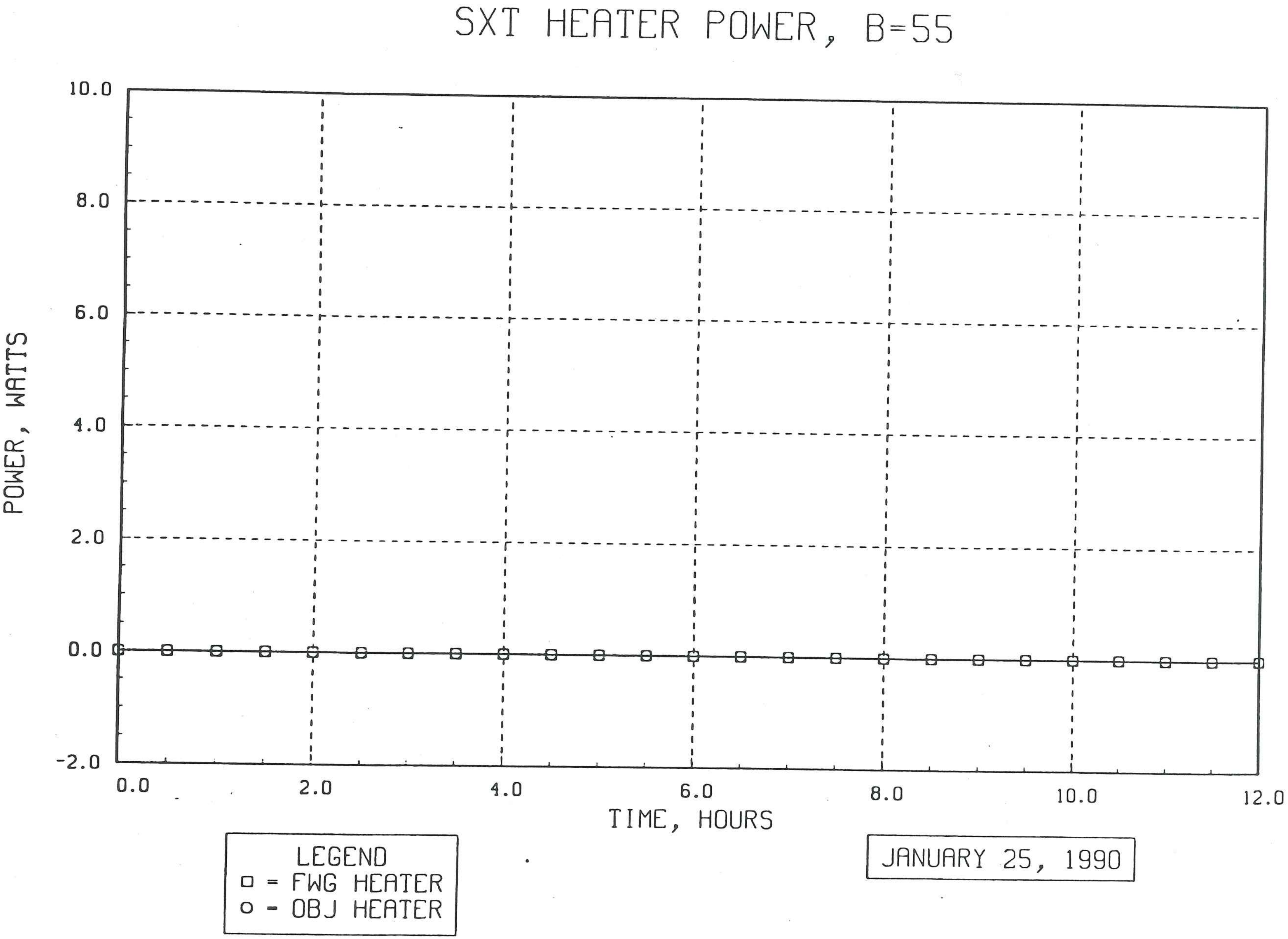


FIGURE G.6-15 SXT WCH TRANSIENT HEATER POWERS

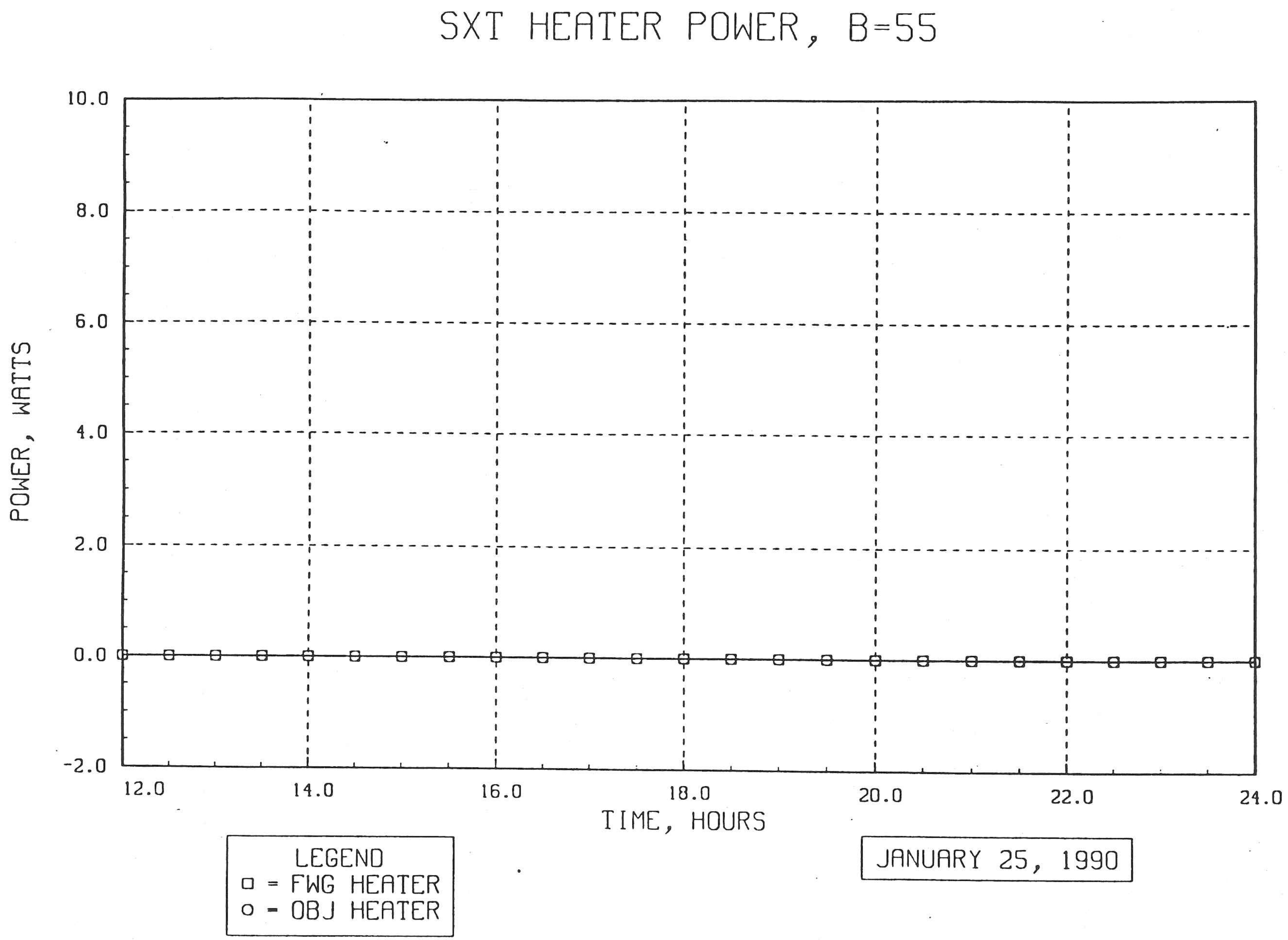


FIGURE G.6-16 SXT WCH TRANSIENT HEATER POWERS

G.7 Conclusions And Recommendations -

The analysis shows that all thermal requirements are currently being met. The agreement between the RTMM and DTMM results is very good with the largest spread , of 1.8 deg C, occuring at the front end.

In the latest revision of the DTMM, the front end MLI was removed. In the RTMM, one node was added (node 15) to accomodate the front end heaters.

Overall, the integrity of the two thermal models is fairly high.

G.8 SXT Front End Absorbed Heat Rates -

The sun shield was assumed to be made of aluminum with the interior painted black. Node 14 (front end) was covered with teflon/aluminum solar reflector material. Node 1, aspect sensor, has the same properties but is made up of quartz with second surface aluminum. The solar properties (a and e) used for the heat rate calculations are indicated in Table G.8-1. The absorbed heat rates are input into the thermal analyzer program and used to determine the heat balance on each node.

Table G.8-1
Surface Properties/Areas

NODE	DESCRIPTION	ALPHA BOL/EOL	EPSILON MIN/MAX	AREA, CM2	EPSILON*
01	ASPECT SENSOR LENS	.12/.19	.79/.81	19.66	--
01a	LENS SURROUNDINGS	.12/.19	.79/.81	81.27	--
01b	LENS SURROUNDINGS	1.0/1.0	1.0/1.0	19.05	--
23	METERING TUBE MLI	.03/.03	.05/.05	1753.57	.025
24	METERING TUBE MLI	.03/.03	.05/.05	1753.57	.025
25	METERING TUBE MLI	.03/.03	.05/.05	1753.57	.025
26	METERING TUBE MLI	.03/.03	.05/.05	1753.57	.025
27	METERING TUBE MLI	.03/.03	.05/.05	1753.57	.025
08	FILTER WHEEL HSG	.03/.03	.05/.05	631.36	.025
14	FRONT END	.12/.19	.79/.81	642.69	--
14	APERTURE	.12/.14	.03/.05	13.24	--
997	SUNSHADE	.94/.97	.85/.85	28.22 LENS AP 108.22 FILTER AP	
998	SPACECRAFT	.94/.97	.85/.85	--	--
998	SPACECRAFT	1.0/1.0	1.0/1.0	--	--
3	TUBE	--	--	1670.07	--
4	TUBE	--	--	1670.07	--
5	TUBE	--	--	1670.07	--
6	TUBE	--	--	1670.07	--
7	TUBE	--	--	1670.07	--
10	UPPER REAR SUPPORT	--	--	--	--
11	LOWER REAR SUPPORT	--	--	--	--
12	FRONT SUPPORT	--	--	--	--
13	FRONT SUPPORT PLATE	--	--	659.37	--
15	OUTER HOUSING RING	--	--	710.28	--

NOTE: EPSILON* is the effective emittance of the MLI blanket.

NOTE: The surface areas for the Tube MLI (Nodes 23-27) and the Tube (nodes 3-7) were calculated with an average diameter. The conduction resisters (Table G.5-1) were calculated with true diameters (i.e. a tapered tube).

NOTE: Surface area were not given for nodes 10, 11, and 12 as they have no exterior radiation couplings.

The surface specularity of each of the front end nodes (that have a view to space) are listed in Table G.8-2.

Table G.8-2
Surface Specularity

Node	Description	IR Specular Fraction	Solar Specular Fraction
01	ASPECT SENSOR LENS	0.0	1.0
01a	LENS SURROUNDINGS	0.0	1.0
01b	LENS SURROUNDINGS	0.0	0.0
14	FRONT END	0.0	1.0
14	APERTURE	0.0	1.0

The front end dimensions and surface designations used in the LPARL HEAT TRACE analysis (Nevada Code) are in Figures G.8-1 and G.8-2. Also shown is the correlation between HEAT TRACE surface designations (node numbers) and the RTMM node numbers.

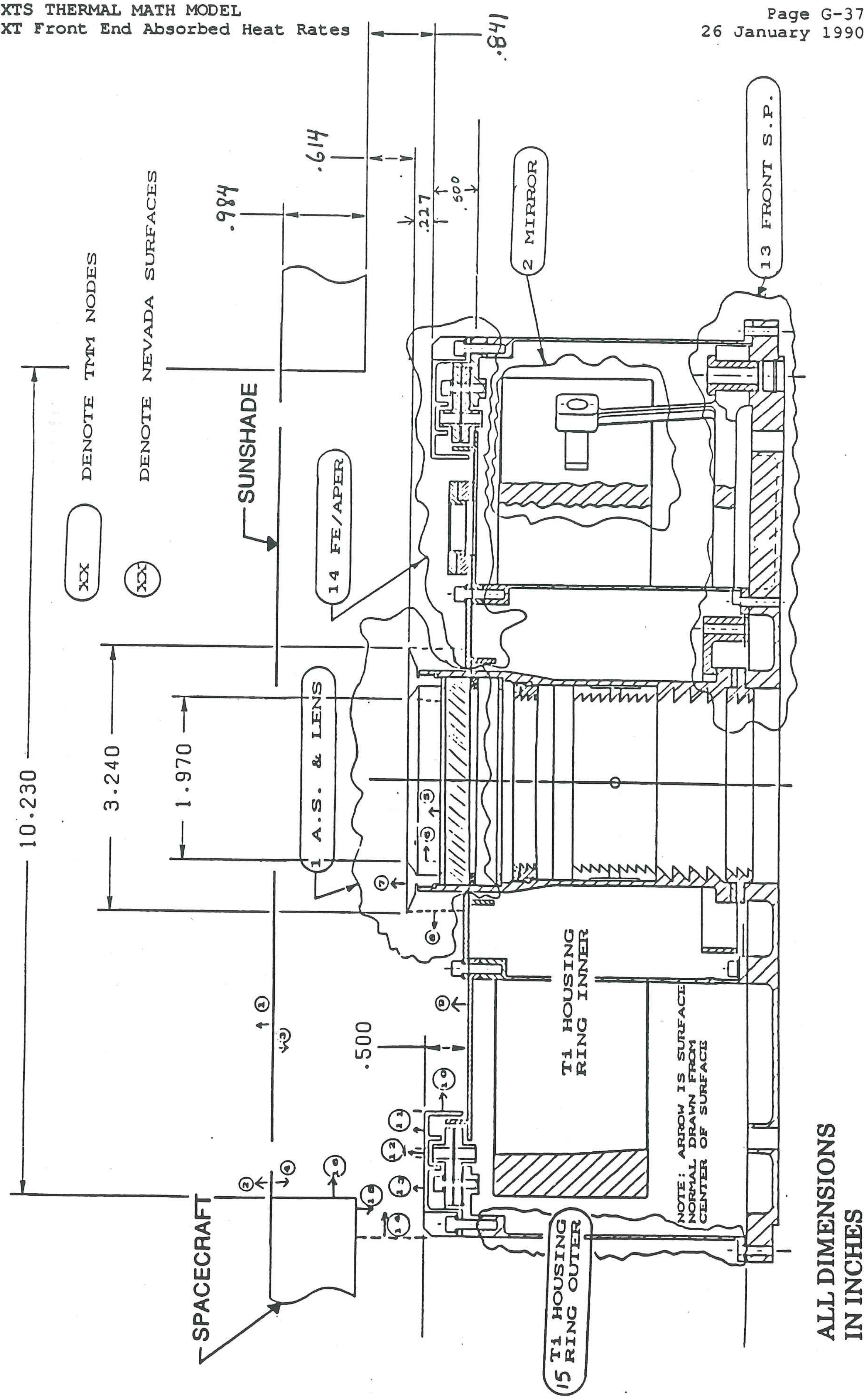


FIGURE G.8-1 SPECULAR SURFACE DESIGNATION

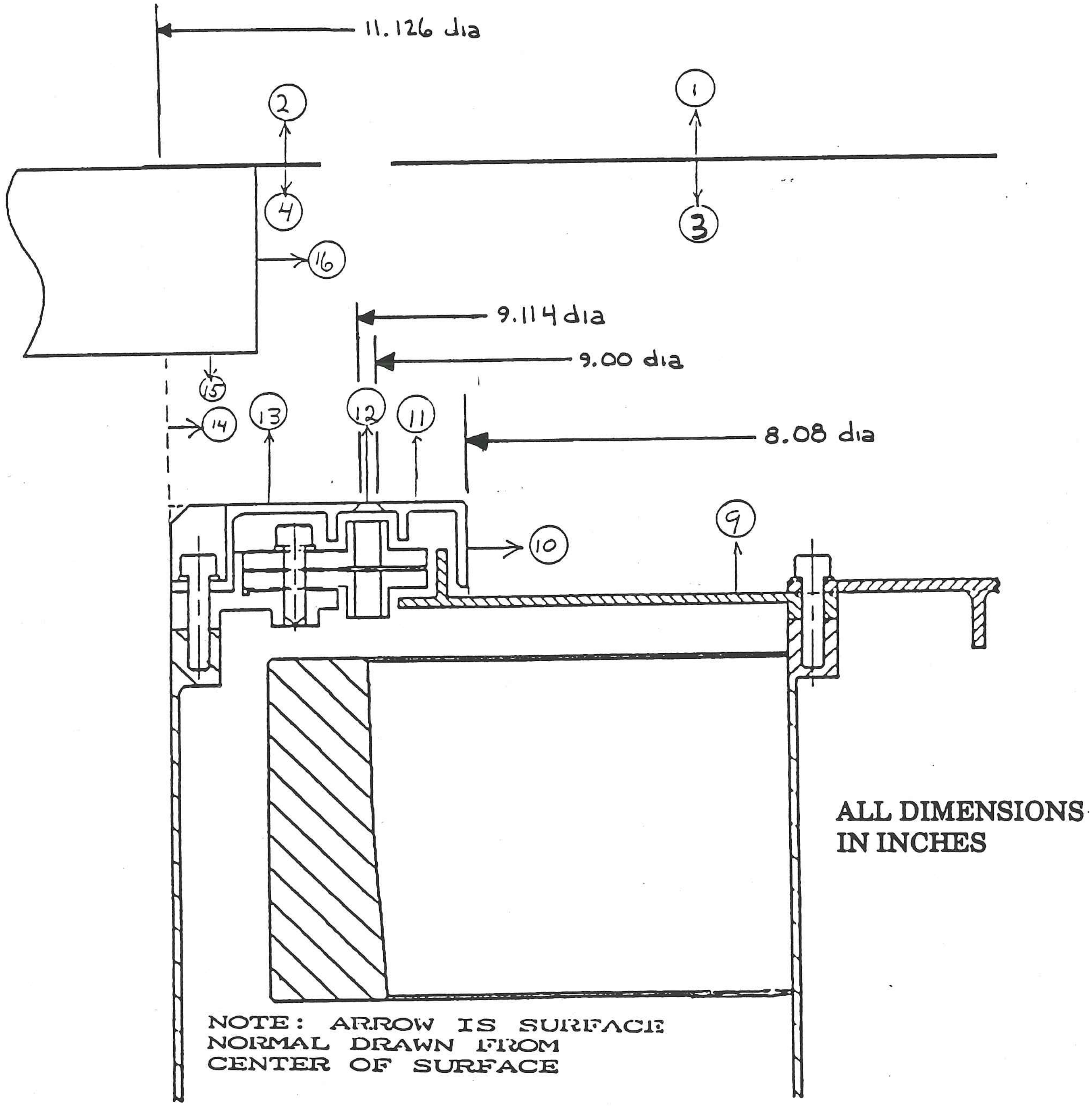


FIGURE G.8-2 DETAILED SPECULAR SURFACE DESIGNATION

APPENDIX H

SXT STRUCTURAL MODEL INFORMATION.

Structural Model Weights:

Revised REV D

30 Nov, 1988 Structural Model for Japan Test SXT-20030

Weight Breakdown

Objective group

Entrance aperture plate	(Al)	alodine surface	.197 kg
Entrance Filter Assembly (12 frames @ 17 g each)	(Al)		.204 Kg
Witness Mirror flight handle	(Al)	anodize	.100 Kg
Witness Mirror Support Rod	(Ti)		.100 Kg
Aspect Sensor Assembly	(Ti)		.521 Kg*
Aspect Sensor Door (w/o blade)	(Al)	anodize	.150 Kg
Aspect Sensor Closeout	(Al)	anodize	.045 Kg
Front PLate	(Al)	alodine	.337 Kg
Inner Ring	(Ti)		.230 Kg
Outer Ring	(Ti)		.575 Kg
Fwd Support Plate	(Ti)		1.120 Kg
Mass Model Mirror with titanium mount ring			1.731 Kg
Mirror FM: Base ring Ti, Zerudor glass			
Mirror Mass Model for structural test: Same as FM			
Mirror Mass Model for Thermal test: All Al			
		sub total	5.310 Kg
			11.583 Lb

Metering Tube Group

Metering Tube		Al foil outside and inside	2.900 Kg
Fwd Support Mount	(Ti)		.116 Kg
Light Baffle	(Al)	anodize	.056 Kg
Aft Support Plate	(Ti)		.661 Kg
Aft Support Plate Mounts (2 total) .137 ea	(Al)(?)		.274 Kg
Spacecraft interface bushings (10 total 4g ea)	(Ti)		.040 Kg
		sub total	4.047 Kg
			8.922 Lb

Focal PLane Group

Filter Wheel Assembly	(mass model)	2.682 Kg
FM: main housing is Ti		
FW Mass Model: Al black anodized		
Shutter Motor	(mass model)	.459 Kg
FM: Al alodine surface, encoder box is black anodized		
SM Mass Model: stailess steel		

	CCD Spacer	anodize	.169 Kg
	CCD Camera (mass model) FM:Ti, radiation shield Al alodine CCDH Mass Model: Ti		.485 Kg
	Misc Screws	stainless	.095 Kg
	Filters in Filter Wheel (10 total)		.xxx
		sub total	3.890 Kg 8.576 Lb
Misc	MLI (.339 Kg, 0.75 Lb) Connectors/Cables TBD.		.339 Kg *
		Total	13.530 Kg * 29.829 Lb *

* changed from rev D

MLI insulation weight for the three blankets is:

FWD blanket = 69 grams

Metering tube blanket = 200 g

Aft blanket = 70 g

Total = 339 g

Note: the Aft blanket is being modified, The mass will decrease.

SXT Aspect Sensor Components Mass Inventory

12/23/88

The following list of Aspect Sensor components together do not comprise the total aspect sensor mass. The following items have been grouped together to yield a total aspect sensor mass of 521.93 grams.

Calculating the total mass of aspect sensor the following items were included:

Aspect Sensor Fused Silica Window:	62.14 grams
Aspect Sensor CM-500 Filter Glass:	53.40 grams
Average mass of lens element #1:	37.70 grams
Average mass of lens element #2:	49.07 grams
Aspect entrance filter retainer ring:	17.34 grams
Aspect entrance filter spacer:	8.10 grams
Aspect lens retainer ring:	12.49 grams
Aspect lens spacer, stainless .008" thickness:	0.69 grams
Aspect aft spacer:	27.31 grams
Aspect housing:	155.74 grams
Aspect concentric ring:	34.76 grams
Aspect sensor clamp:	46.09 grams
Aspect sensor spacer:	17.10 grams
Total Approximate Mass:	521.93 grams

Other components:

Aspect Lens set A, element #1:	37.60 grams
Aspect Lens set A, element #2:	48.99 grams
Aspect Lens set B, element #1:	37.77 grams
Aspect Lens set B, element #2:	49.18 grams
Aspect Lens set C, element #1:	37.64 grams
Aspect Lens set C, element #2:	49.11 grams
Aspect Lens set D, element #1:	37.78 grams
Aspect Lens set D, element #2:	49.01 grams
Aspect lens spacer, 5mm thickness:	14.65 grams
Dummy aspect entrance window:	56.61 grams

shim material is stainless steel, type 304.

Configuration of the Structural Model for Structural/Thermal tests in Japan

Mass models were used for the Filter Wheel, Shutter Motor and CCDH.
For Structural/Thermal model envelope drawing see Figure H.1-1.
For Structural/Thermal model bushings see Figure H.1-2.
For Structural/Thermal model surface info. see Figure H.1-3.
For Structural model box isolators see Figure H.1-4.
For Accelerometer mounting location see figure H.1-6.
For Structural model Aspect subsystem see figure H.1-7.

Data from structural model reports:

date	10/17/88	12/14/88
Metering Tube length (in)	54.43	54.211
Diameter 1 (in)	10.65	
Diameter 2 (in)	6.00	
Mass (kg)	13.692	13.583
CG (cm)		
u1	74.933	74.048
u2	10.385	10.385
u3	13.312	13.331
MOI (g-cm^2) with respect to the mass center		
Iu1,u1	0.1414E+7	0.1399E+7
Iu2,u2	0.6306E+8	0.6216E+8
Iu3,u3	0.6300E+8	0.6210E+8

In 12/14 report Aft support sides were Al

Accelerometer used for structural tests in U.S.A had a 0-5 KHZ frequency range and 0-200 G amplitude range, with 3 axis measurements. The accelerometers in structural test in Japan were attached to SXTS on plastic cubes with 12mm sides. For 3 axis measurement, 3 sensors were attached to 3 orthogonal surfaces of the cube. The height of the accelerometer was about 0.33 in. or 0.64 in. Accelerometer positions are indicated in Figure H-1-6.

Thermal test configuration of the Structural Model test in Japan

For MLI drawing see figure H.1-5.
For Thermal model information see chapter 3 and appendix G.
For Alpha Epsilon difference between FM and Structural Model see Appendix G.
For temperature definition point see bottom of page 3-2.
For thermal resistors difference see table G.5-1.
For thermal capacitance difference see table G.5-3.

In the thermal test Flight washers described in page 3-6 and Figures 3.3-5B and 3.3-5C were used on CCDE/P box. NEC washers were used on other boxes. The mirror used was the Aluminum Mass model.
Mass models were used for the Filter Wheel, Shutter Motor and CCDH.
The power dissipated in the FPG was simulated by using a resistor.

The temp sensors on the electronics boxes were located on the sides of the boxes to measure the mean temperature of each box.
The E-boxes were heated with internal resistors.

The thermal test was conducted at ISAS using the large vaccum chamber.
The spacecraft was heated using heater wires. The cooling was done by using a shroud.

Method of attaching temperature sensors to SXTS:
Lay down kapton tape then the sensor then cover it with kapton tape.
X-ray slits were taped.

Resistors to simulate TEC and FPG

From table 3.2-1
Total FPG power = 0.99 W
Total TEC power = 3.36 W

To simulate this power during structural thermal test two resistors are used powered from 15 volts using DEM-9P type connector (ITT CANNON ELECTRIC). R (FPG) is connected between connector pins 1 and 3 and R (TEC) is connected between connector pins 7 and 9.

R (FPG) = 15 X 15 / .99 = 225 ohm

220 ohm 10 W resistor was selected.

R (TEC) = 15 X 15 / 3.36 = 67 ohm

70 ohm 25 W resistor was selected.

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APPENDIX I

ENGINEERING MODEL TESTS

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APPENDIX J

FLIGHT MODEL TESTS

J.1 MIC -

1. Visual inspection of surface finish, connector name marking,box name marking.
2. Measurement of weight, center of gravity, surface flatness, and surface roughness.
3. Integration of instruments to the spacecraft.
4. Mechanical fit check and clearance check.
5. Harness fit check and clearance check.

J.1.1 EIC -

1. Check of power and grounding layout (power bus lines, grounding lines, and chassis isolation)
2. Electronic interface check.
3. spacecraft electronic system test.
4. CCDE/P/H grounding performance check.

J.2 Spacecraft Integration Test- -

Spacecraft integration test is as follows:

1. MIC and mechanical integration.
2. Electronic performance test.
3. CCDP/E/H grounding performance test
4. Temperature test (-20 C - +50 C)
5. Dynamic balance test (coarse).
6. Alignment measurement and adjustment.
7. Shock test.
8. Vibration test (3 axes).
9. Thermal vacuum test.
10. Alignment measurement and adjustment.
11. Battery Reconditioning.
12. Measurement of center of gravity.
13. Dynamic balance test (fine).
14. Measurement of MOI.
15. Final electronic performance test.
16. Final visual inspection.
17. Spacecraft in the container for the transportation to KSC.

J.3 Alignment Verification -

J.3.1 Alignment Requirement -

The optical axes of Solar-A instruments with small field of view (TFSS [two dimensional sun sensor], SXT, HXT, BCS) should fall in the specifed cone angle around the axes defined by the spacecraft master alignment mirror located in the rocket connection ring. This arrangement assures the sufficient overlap of FOV of those alignment-sensitive instruments. The maximum misalignment angle of SXT is shown in Table J.2-1.

Table J.2-1
SXT misalignment angle (absolute*)

	Maximum misalignment angle (arcmin)		
	X axis	Y axis	Z axis
SXT-spacecraft reference	3.0	6.0	6.0

*Knowledge of information will be much better.

J.3.2 Drilling Procedure -

Procedures in the US
1. SXTS optical axis - SXTS alignment cube
The misalignment angle of SXTS optical axis with SXTS alignment cube is measured by collimator (a theodolite): (Ax, Ay)
2. SXTS alignment cube - SXTS drilling template cube
The misalignment angle of SXTS cube with an alignment cube on the SXTS drilling template is measured with Theodolite and Azimuth refference mirror: (Bx, By). Total misalignment angle of SXTS optical axis with the mirror on the template is (Cx, Cy)=(Ax+Bx, Ay+By), and is reported to the Japanese side.

Procedures in Japan
3. Drilling holes in the spacecraft panel
The template is put on the drawing-specified location on the panel. Slight adjustment will be made such that Y axis misaligment of SXTS optical axis relative to the spacecraft reference is zero. This is done by using the mirror on the spacecraft panel. The misalignment of the mirror on the panel relative to the master mirror on the rocket connection ring is measured beforehand using autocollimator and mirror..

Procedures in the US
4. SXTS alignment cube - SXTS drilling template cube
The template is returned to the US, and the misalignment angle of SXTS cube with a alignment cube on the template is again measured for confirmation purpose.

J.3.3 Alignment Measurement And Correction -

The measurement of the SXTS misalignment angle is optically done with the mirrors on SXTS and on spacecraft, and the levelled table on which the spacecraft is mounted.
All The equipment needed for the alignment is prepared by Japanese side.

Measurements of SXTS alignment with spacecraft after its integration to the spacecraft are done in the following occasions:

Before the vibration test of the structural model
After the vibration test of the structural model
Before the vibration test of the flight model
After the vibration test of the flight model

The alignment measurement should be made in the configration that the spacecraft top panel and side panels with electronics boxes are integrated to minimize the positional uncertainty of the center panel relative to the rocket connection ring.

If the measured misalgnment angle around X and Z axis is larger than the required values in section J.2.1, the correction of the misalignment should be made by shimming between SXTS flange and the spacecraft:

Shim:	prepared by:	U side. Stainless steel.
	shape and size:	Plate with holes for screws. The size is the same as the footpoint sizes of SXTS upper and lower flanges.
	Thickness:	0.5 mm, 1 mm, 1. 5 mm, 2 mm

The misalignment around Y axis should be within the specification due to the procedure taken in drilling. Larger misalignment angle around Y axis is an emergency case, and the correcting procedure is to redesign the aft mounting brackets to accomodate the offset.

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APPENDIX K

TELEMETRY WORDS AND BITS

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APPENDIX L

HARNESS, CONNECTOR AND PIN ASSIGNMENT

計装配線表　目次　90/09/11 13:42:06

SOLAR-A SXT harness list

Sep. 11, 1990

FINAL revision for FLIGHT

CCDE-1 ST 11956-15(S)

8	T	**TEST**·					SPARE(CCDE-1)-1	[]
11	T	**TEST**·					SPARE(CCDE-1)-2	[]
14	T	**TEST**·					CHASSIS GROUND(CCDE-1)-1	[]
15	T	**TEST**·					SPARE(CCDE-1)-3	[]
1	P	CCDP-3	·01	P	A		15V TEMP CONT	[]
9	P	CCDP-3	·09	P	A		-15V TEMP CONT	[]
10	P	CCDP-3	·10	P	A		+/-15V RTN-1	[]
2	P	CCDP-3	·02	P	B		15V SIG CHAIN	[]
7	P	CCDP-3	·07	P	B		-15V SIG CHAIN-1	[]
3	P	CCDP-3	·03	P	C		5V ADC	[]
5	P	CCDP-3	·05	P	C		5V ADC RETURN	[]
4	P	CCDP-3	·04	P	D		5V INPUT(CCDP)	[]
12	P	CCDP-3	·12	P	D		5V RETURN(CCDP)	[]
6	P	CCDP-3	·06	P	E		TEC DRIVE (+)	[]
13	P	CCDP-3	·13	P	E		TEC DRIVE RETURN (-)	[]

CCDE-2 ST 11956-9(S)

3	T	**TEST**·					SPARE(CCDE-2)-1	[]
2		SXTS-2	·02				PPAR	[]
4		SXTS-2	·04				TRANSFER GATE	[]
6		SXTS-2	·06				PSUM	[]
5		SXTS-2	·05	P	A		TEC CONTROL (+)	[]
9		SXTS-2	·09	P	A		TEC CONTROL RETURN (-)	[]
1		SXTS-2	·01	S		08	PSERIAL	[]
7		SXTS-2	·07	S		08	RESET(SXT)	[]
8		SXTS-2	·08			08	CHASSIS GROUND(CCDE-SXTS)	[]

CCDE-3 ST 11957-9(P)

9	T	**TEST**·					SPEARE(CCDE-3)	[]
3		SXTS-3	·03	P	B		+15V SIG CHAIN	[]
4		SXTS-3	·04	P	B		-15V SIG CHAIN-2	[]
8		SXTS-3	·08	P	B		+/-15V RTN-2	[]
5		SXTS-3	·05	P	C		T1 TEC CJ TEMP	[]
7		SXTS-3	·07	P	C		T2 CCD CJ TEMP REN	[]
1		SXTS-3	·01	T	A	02	VIDEO	[]
6		SXTS-3	·06	T	A	02	VIDEO RTN	[]
2		SXTS-3	·02			02	VIDEO SHIELD	[]

CCDE-4 ST 11956-25(S)

1	————	CCDP-5	·01			DA0 (LSB)	[]
2	————	CCDP-5	·02			DA 1	[]
3	————	CCDP-5	·03			DA 2	[]
4	————	CCDP-5	·04			DA 3	[]
5	————	CCDP-5	·05			DA 4	[]
6	————	CCDP-5	·06			DA 5	[]
7	————	CCDP-5	·07			DA 6	[]
8	————	CCDP-5	·08			DA 7	[]
9	————	CCDP-5	·09			DA 8	[]
10	————	CCDP-5	·10			DA 9	[]
11	————	CCDP-5	·11			DA 10	[]
12	————	CCDP-5	·12			DA 11 (MSB)	[]
13	————	CCDP-5	·13			DA_TSC	[]
14	————	CCDP-5	·14			SERIAL_GATE	[]
15	————	CCDP-5	·15			BLS #	[]
16	————	CCDP-5	·16			SUM	[]
17	————	CCDP-5	·17			PARR#	[]
18	————	CCDP-5	·18			34.5KHZ(SXT)	[]
20	————	CCDP-5	·20			260KHZ(SXT)	[]
21	————	CCDP-5	·21			COM SYNCH	[]
23	————	CCDP-5	·23			1ST LINE #	[]
24	————	CCDP-5	·24			FAST SERIAL	[]
25	————	CCDP-5	·25			CCD_TEMP	[]
19	— —	CCDP-5	·19	P	A	130KHZ(SXT)	[]
22	— —	CCDP-5	·22	P	A	130KHZ RTN(SXT)	[]

CCDP-1 311P10-2S-B-12 (DAM-15S-NMB-K52)

13		T	**TEST**·			TEST	[]
5	————		SXTEU-10·05	26HT	N	MONITOR RELAY COMMON	[]
6	————		SXTEU-10·06	26HT	N	DAY/NIGHT RELAY (DAY-CLOSE)	[]
7	————		SXTEU-10·07	26HT	N	TEC RELAY (CLOSE-TEC ACTIVE)	[]
14	————		SXTEU-10·14	20GK	0	CCDP SECONDARY RTN	[]
1	— —	P	SXTEU-10·01	22GKP2	A	28V TO CCD PDU-1	[]
15	— —	P	SXTEU-10·15	22GKP0	A	28V RTN-2(SXT)	[]
2	— —	P	SXTEU-10·02	22GKP2	B	15V TO TEC RELAY	[]
3	— —	P	SXTEU-10·03	22GKP0	B	TEC ARM PULSE RESET	[]
11	— —	P	SXTEU-10·11	22GKP0	B	TEC ARM PULSE SET	[]
4	— —	P	SXTEU-10·04	22GKP0	C	NIGHT PWR ARM RESET	[]
10	— —	P	SXTEU-10·10	22GKP2	C	15V NIGHT RELAY	[]
12	— —	P	SXTEU-10·12	22GKP0	C	NIGHT PWR ARM SET	[]
8	— —	P	SXTEU-10·08	22GKP2	D	28V TO CCD PDU-2	[]
9	— —	P	SXTEU-10·09	22GKP0	D	28V RTN-1(SXT)	[]

CCDP-2 311P10-4S-B-12 (DCM-37S-NMB-K52)

18		T **TEST**·				SPARE(CCDP-2)-1	[ ]
19		T **TEST**·				SPARE(CCDP-2)-2	[ ]
37		T **TEST**·				SPARE(CCDP-2)-3	[ ]
1	—∏—	SXTEU-8	·01	26HTPN	A	IMAGE DATA 0+ (LSB)	[ ]
20	—∐—	SXTEU-8	·20	26HTPN	A	IMAGE DATA 0-	[ ]
2	—∏—	SXTEU-8	·02	26HTPN	B	IMAGE DATA 1+	[ ]
21	—∐—	SXTEU-8	·21	26HTPN	B	IMAGE DATA 1-	[ ]
3	—∏—	SXTEU-8	·03	26HTPN	C	IMAGE DATA 2+	[ ]
22	—∐—	SXTEU-8	·22	26HTPN	C	IMAGE DATA 2-	[ ]
4	—∏—	SXTEU-8	·04	26HTPN	D	IMAGE DATA 3+	[ ]
23	—∐—	SXTEU-8	·23	26HTPN	D	IMAGE DATA 3-	[ ]
5	—∏—	SXTEU-8	·05	26HTPN	E	IMAGE DATA 4+	[ ]
24	—∐—	SXTEU-8	·24	26HTPN	E	IMAGE DATA 4-	[ ]
6	—∏—	SXTEU-8	·06	26HTPN	F	IMAGE DATA 5+	[ ]
25	—∐—	SXTEU-8	·25	26HTPN	F	IMAGE DATA 5-	[ ]
7	—∏—	SXTEU-8	·07	26HTPN	G	IMAGE DATA 6+	[ ]
26	—∐—	SXTEU-8	·26	26HTPN	G	IMAGE DATA 6-	[ ]
8	—∏—	SXTEU-8	·08	26HTPN	H	IMAGE DATA 7+	[ ]
27	—∐—	SXTEU-8	·27	26HTPN	H	IMAGE DATA 7-	[ ]
9	—∏—	SXTEU-8	·09	26HTPN	I	IMAGE DATA 8+	[ ]
28	—∐—	SXTEU-8	·28	26HTPN	I	IMAGE DATA 8-	[ ]
10	—∏—	SXTEU-8	·10	26HTPN	J	IMAGE DATA 9+	[ ]
29	—∐—	SXTEU-8	·29	26HTPN	J	IMAGE DATA 9-	[ ]
11	—∏—	SXTEU-8	·11	26HTPN	K	IMAGE DATA 10+	[ ]
30	—∐—	SXTEU-8	·30	26HTPN	K	IMAGE DATA 10-	[ ]
12	—∏—	SXTEU-8	·12	26HTPN	L	IMAGE DATA 11+ (MSB)	[ ]
31	—∐—	SXTEU-8	·31	26HTPN	L	IMAGE DATA 11-	[ ]
13	—∏—	SXTEU-8	·13	26HTPN	M	FRAME GATE+	[ ]
32	—∐—	SXTEU-8	·32	26HTPN	M	FRAME GATE-	[ ]
14	—∏—	SXTEU-8	·14	26HTPN	N	WORD SYNC+	[ ]
33	—∐—	SXTEU-8	·33	26HTPN	N	WORD SYNC-	[ ]
15	—∏—	SXTEU-8	·15	26HTPN	O	LINE SYNC 1+	[ ]
34	—∐—	SXTEU-8	·34	26HTPN	O	LINE SYNC 1-	[ ]
16	—∏—	SXTEU-8	·16	26HTPN	P	LINE SYNC 2+	[ ]
35	—∐—	SXTEU-8	·35	26HTPN	P	LINE SYNC 2-	[ ]
17	—∏—	SXTEU-8	·17	26HTPN	Q	LINE SYNC 3+	[ ]
36	—∐—	SXTEU-8	·36	26HTPN	Q	LINE SYNC 3-	[ ]

CCDP-3 ST 11957-15(P)

8	T	**TEST**·				SPARE(CCDP-3)-1	[]
11	T	**TEST**·				SPARE(CCDP-3)-2	[]
14	T	**TEST**·				CHASSIS GROUND(CCDP-3)-1	[]
15	T	**TEST**·				SPARE(CCDP-3)-3	[]
1	P	CCDE-1	·01	P	A	15V TEMP CONT	[]
9	P	CCDE-1	·09	P	A	-15V TEMP CONT	[]
10	P	CCDE-1	·10	P	A	+/-15V RTN-1	[]
2	P	CCDE-1	·02	P	B	15V SIG CHAIN	[]
7	P	CCDE-1	·07	P	B	-15V SIG CHAIN-1	[]
3	P	CCDE-1	·03	P	C	5V ADC	[]
5	P	CCDE-1	·05	P	C	5V ADC RETURN	[]
4	P	CCDE-1	·04	P	D	5V INPUT(CCDP)	[]
12	P	CCDE-1	·12	P	D	5V RETURN(CCDP)	[]
6	P	CCDE-1	·06	P	E	TEC DRIVE (+)	[]
13	P	CCDE-1	·13	P	E	TEC DRIVE RETURN (-)	[]

CCDP-4 311P10-1S-B-12 (DEM-9S-NMB-K52)

2	T	**TEST**·				SPARE(CCDP-4)-1	[]
3	T	**TEST**·				SPARE(CCDP-4)-2	[]
5	T	**TEST**·				SPARE(CCDP-4)-3	[]
7	T	**TEST**·				SPARE(CCDP-4)-4	[]
8	T	**TEST**·				SPARE(CCDP-4)-5	[]
1		SXTEU-7	·01	26HTPN	A	DCLK+	[]
6		SXTEU-7	·06	26HTPN	A	DCLK-	[]
4		SXTEU-7	·04	26HTPN	B	DATA+	[]
9		SXTEU-7	·09	26HTPN	B	DATA-	[]

CCDP-5 ST 11957-25(P)

1	———	CCDE-4	·01			DA0 (LSB)	[ ]
2	———	CCDE-4	·02			DA 1	[ ]
3	———	CCDE-4	·03			DA 2	[ ]
4	———	CCDE-4	·04			DA 3	[ ]
5	———	CCDE-4	·05			DA 4	[ ]
6	———	CCDE-4	·06			DA 5	[ ]
7	———	CCDE-4	·07			DA 6	[ ]
8	———	CCDE-4	·08			DA 7	[ ]
9	———	CCDE-4	·09			DA 8	[ ]
10	———	CCDE-4	·10			DA 9	[ ]
11	———	CCDE-4	·11			DA 10	[ ]
12	———	CCDE-4	·12			DA 11 (MSB)	[ ]
13	———	CCDE-4	·13			DA_TSC	[ ]
14	———	CCDE-4	·14			SERIAL_GATE	[ ]
15	———	CCDE-4	·15			BLS #	[ ]
16	———	CCDE-4	·16			SUM	[ ]
17	———	CCDE-4	·17			PARR#	[ ]
18	———	CCDE-4	·18			34.5KHZ(SXT)	[ ]
20	———	CCDE-4	·20			260KHZ(SXT)	[ ]
21	———	CCDE-4	·21			COM SYNCH	[ ]
23	———	CCDE-4	·23			1ST LINE #	[ ]
24	———	CCDE-4	·24			FAST SERIAL	[ ]
25	———	CCDE-4	·25			CCD_TEMP	[ ]
19	—╥—	CCDE-4	·19	P	A	130KHZ(SXT)	[ ]
22	—╨—	CCDE-4	·22	P	A	130KHZ RTN(SXT)	[ ]

FDE-1 311P10-2S-B-12 (DAM-15S-NMB-K52)

5	T	**TEST**·				TEST	[ ]
14	T	**TEST**·				CHASSIS GROUND(FDE-1)	[ ]
15	T	**TEST**·				TEST	[ ]
4	———	SXTEU-9	·03	26HT	N	+5V TO LED ANODES FDE-A	[ ]
6	———	SXTEU-4	·03	26HT	N	STEP FDEA DR A	[ ]
7	———	SXTEU-4	·01	26HT	N	DIR FDEA DR A	[ ]
8	———	SXTEU-4	·02	26HT	N	EN FDEA DR A	[ ]
11	———	SXTEU-4	·11	26HT	N	STEP FDEA DR B	[ ]
12	———	SXTEU-4	·09	26HT	N	DIR FDEA DR B	[ ]
13	———	SXTEU-4	·10	26HT	N	EN FDEA DR B	[ ]
1	—╥— P	SXTEU-9	·01	22GKP2	A	28V TO FDEA	[ ]
9	—╨— P	SXTEU-9	·02	22GKP0	A	28V RTN FDEA	[ ]
2	—╥— P	SXTEU-9	·21	22GKP0	B	RELAY COM-SEL FDEA FWB DR B	[ ]
3	—╫— P	SXTEU-9	·15	22GKP0	B	RELAY COM-SEL FDEA FWA DR A	[ ]
10	—╨— P	SXTEU-9	·14	22GKP2	B	+15V RELAY POWER FDE-A	[ ]

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FDE-2      311P10-2S-B-12 (DAM-15S-NMB-K52)
[5 ]          T **TEST**·                      TEST                                [ ]
[14]          T **TEST**·                      CHASSIS GROUND(FDE-2)               [ ]
[15]          T **TEST**·                      TEST                                [ ]
[4 ] ————————   SXTEU-9 ·06 26HT N             +5V TO LED ANODES FDE-B             [ ]
[6 ] ————————   SXTEU-4 ·06 26HT N             STEP FDEB DR A                      [ ]
[7 ] ————————   SXTEU-4 ·04 26HT N             DIR FDEB DR A                       [ ]
[8 ] ————————   SXTEU-4 ·05 26HT N             EN FDEB DR A                        [ ]
[11] ————————   SXTEU-4 ·14 26HT N             STEP FDEB DR B                      [ ]
[12] ————————   SXTEU-4 ·12 26HT N             DIR FDEB DR B                       [ ]
[13] ————————   SXTEU-4 ·13 26HT N             EN FDEB DR B                        [ ]
[1 ] — ╥ — P  SXTEU-9 ·04 22GKP2 A             28V TO FDEB                         [ ]
[9 ] — ╨ — P  SXTEU-9 ·05 22GKP0 A             28V RTN FDEB                        [ ]
[2 ] — ╥ — P  SXTEU-9 ·24 22GKP0 B             RELAY COM-SEL FDEB FWB DR B         [ ]
[3 ] — ╫ — P  SXTEU-9 ·18 22GKP0 B             RELAY COM-SEL FDEB FWA DR A         [ ]
[10] — ╨ — P  SXTEU-9 ·17 22GKP2 B             +15V RELAY POWER FDE-B              [ ]

FDE-3      311P10-1P-B-12 (DEM-9P-NMB-K52)
[3 ]          T **TEST**·                      CHASSIS GROUND(FDE-3)-1             [ ]
[7 ]          T **TEST**·                      CHASSIS GROUND(FDE-3)-2             [ ]
[8 ]          T **TEST**·                      TEST                                [ ]
[1 ] — ╥ — P  SXTS-4  ·01 22GKP0 A             FWA MOTOR PH A                      [ ]
[2 ] — ╫ — P  SXTS-4  ·02 22GKP0 A             FWA MOTOR PH B                      [ ]
[6 ] — ╨ — P  SXTS-4  ·06 22GKP0 A             FWA MOTOR PH C                      [ ]
[4 ] — ╥ — P  SXTS-4  ·04 22GKP0 B             FWB MOTOR PH A                      [ ]
[5 ] — ╫ — P  SXTS-4  ·05 22GKP0 B             FWB MOTOR PH B                      [ ]
[9 ] — ╨ — P  SXTS-4  ·09 22GKP0 B             FWB MOTOR PH C                      [ ]
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SXTEU-1   311P10-4P-B-12 (DCM-37P-NMB-K52)
|7 |        T **TEST**·                 CHASSIS GROUND(SXTEU-1)-1     []
|20|        T **TEST**·                 CHASSIS GROUND(SXTEU-1)-2     []
|21|        T **TEST**·                 CHASSIS GROUND(SXTEU-1)-3     []
|30|        T **TEST**·                 CHASSIS GROUND(SXTEU-1)-4     []
|35|        T **TEST**·                 CHASSIS GROUND(SXTEU-1)-5     []
|1 |--------  DPSX17   ·11 26HT N       SXT-STAT-REQ                  []
|2 |--------  DPSX17   ·37 26HT N       SXT-CMD-STRB                  []
|3 |--------  DPSX17   ·14 26HT N       SXT-ADR0                      []
|4 |--------  DPSX17   ·13 26HT N       SXT-ADR2                      []
|5 |--------  DPSX17   ·31 26HT N       SXT-ADR4                      []
|6 |--------  DPSX17   ·29 26HT N       SXT-ADR6                      []
|8 |--------  DPSX17   ·36 26HT N       SXT-CMD0                      []
|9 |--------  DPSX17   ·18 26HT N       SXT-CMD2                      []
|10|--------  DPSX17   ·17 26HT N       SXT-CMD4                      []
|11|--------  DPSX17   ·33 26HT N       SXT-CMD6                      []
|12|--------  DPSX17   ·10 26HT N       SXT-STAT-RDY                  []
|13|--------  DPSX17   ·08 26HT N       SXT-STAT1                     []
|14|--------  DPSX17   ·06 26HT N       SXT-STAT3                     []
|15|--------  DPSX17   ·04 26HT N       SXT-STAT5                     []
|16|--------  DPSX17   ·02 26HT N       SXT-STAT7                     []
|22|--------  DPSX17   ·32 26HT N       SXT-ADR1                      []
|23|--------  DPSX17   ·12 26HT N       SXT-ADR3                      []
|24|--------  DPSX17   ·30 26HT N       SXT-ADR5                      []
|25|--------  DPSX17   ·28 26HT N       SXT-ADR7                      []
|26|--------  DPSX17   ·35 26HT N       SXT-CMD1                      []
|27|--------  DPSX17   ·34 26HT N       SXT-CMD3                      []
|28|--------  DPSX17   ·16 26HT N       SXT-CMD5                      []
|29|--------  DPSX17   ·15 26HT N       SXT-CMD7                      []
|31|--------  DPSX17   ·09 26HT N       SXT-STAT0                     []
|32|--------  DPSX17   ·07 26HT N       SXT-STAT2                     []
|33|--------  DPSX17   ·05 26HT N       SXT-STAT4                     []
|34|--------  DPSX17   ·03 26HT N       SXT-STAT6                     []
|17|- -o- -   DPSX16   ·16 26HTSN   36  SXT-HARD-RST                  []
|36|-  ┘               ·   22GK 0   36  SHIELD(SXTEU-1)-1             []
|18|- -o- -   DPSX16   ·17 26HTSN   37  SXT-SOFT-RST                  []
|37|-  ┘               ·   22GK 0   37  SHIELD(SXTEU-1)-2             []
|19|          *BLANK*  ·                                              []
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SXTEU-2   311P10-3P-B-12 (DBM-25P-NMB-K52)
[14]        T **TEST**·                 SHIELD(SXTEU-2)-1               []
[15]        T **TEST**·                 SHIELD(SXTEU-2)-2               []
[16]        T **TEST**·                 SHIELD(SXTEU-2)-3               []
[21]        T **TEST**·                 SHIELD FOR IMAGE DATA LINES     []
[24]        T **TEST**·                 LINE SYNC 1                     []
[25]        T **TEST**·                 LINE SYNC 2                     []
[1 ] —⊖—     DPSX15  ·14 26HTSN         SXT-LN-SYNC3                    []
[2 ] —⊖—     DPSX16  ·18 26HTSN         SXT-WD-SYNC                     []
[3 ] —⊖—     DPSX15  ·15 26HTSN         SXT-FRM-GATE                    []
[4 ] —⊖—     DPSX15  ·02 26HTSN         SXT-IMG-D0                      []
[5 ] —⊖—     DPSX15  ·03 26HTSN         SXT-IMG-D1                      []
[6 ] —⊖—     DPSX15  ·04 26HTSN         SXT-IMG-D2                      []
[7 ] —⊖—     DPSX15  ·05 26HTSN         SXT-IMG-D3                      []
[17] —⊖—     DPSX15  ·09 26HTSN         SXT-IMG-D4                      []
[18] —⊖—     DPSX15  ·10 26HTSN         SXT-IMG-D5                      []
[19] —⊖—     DPSX15  ·11 26HTSN         SXT-IMG-D6                      []
[20] —⊖—     DPSX15  ·12 26HTSN         SXT-IMG-D7                      []
[8 ]         *BLANK* ·                                                  []
[9 ]         *BLANK* ·                                                  []
[10]         *BLANK* ·                                                  []
[11]         *BLANK* ·                                                  []
[12]         *BLANK* ·                                                  []
[13]         *BLANK* ·                                                  []
[22]         *BLANK* ·                                                  []
[23]         *BLANK* ·                                                  []
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Camera Data

計装配線表

SXTEU-3 311P10-4S-B-12 (DCM-37S-NMB-K52)

14		T	**TEST**	·			CHASSIS GROUND(SXTEU-3)-1	[ ]
20		T	**TEST**	·			CHASSIS GROUND(SXTEU-3)-2	[ ]
28		T	**TEST**	·			CHASSIS GROUND(SXTEU-3)-3	[ ]
31		T	**TEST**	·			CHASSIS GROUND(SXTEU-3)-4	[ ]
7	———	P	PCU-1	·36	20GK	0	UPG(PCU=SXT)	[ ]
9	———		DPSX16	·25	26HT	N	SXT-CMD-B0	[ ]
10	———		DPSX16	·24	26HT	N	SXT-CMD-B1	[ ]
11	———		DPSX16	·23	26HT	N	SXT-CMD-B2	[ ]
12	———		DPSX16	·22	26HT	N	SXT-CMD-B3	[ ]
13	———		DPSX16	·21	26HT	N	SXT-DEC-STRB	[ ]
18	———		DPSX16	·09	26HT	N	SXT-STAT-G	[ ]
19	———		DPSX16	·08	26HT	N	SXT-STAT-H	[ ]
21	———		DPSX16	·15	26HT	N	SXT-STAT-A	[ ]
22	———		DPSX16	·14	26HT	N	SXT-STAT-B	[ ]
23	———		DPSX16	·13	26HT	N	SXT-STAT-C	[ ]
24	———		DPSX16	·12	26HT	N	SXT-STAT-D	[ ]
25	———		DPSX16	·11	26HT	N	SXT-STAT-E	[ ]
26	———		DPSX16	·10	26HT	N	SXT-STAT-F	[ ]
1	—╥—	P	DIST-6	·13	20GKP2	A	+5V(SXTE-U)	[ ]
2	—╨—	P	DIST-8	·22	20GKP0	A	COM(2)(SXTE-U)	[ ]
3	—╥—	P	DIST-12	·10	22GKP2	B	+15V(SXTE-U)	[ ]
4	—╨—	P	DIST-12	·28	22GKP0	B	COM(RL)(SXTE-U)	[ ]
5	—╥—	P	DIST-10	·18	22GKP2	C	+28V(SXTE-U)	[ ]
6	—╨—	P	DIST-10	·36	22GKP0	C	COM(1)(SXTE-U)	[ ]
29	—╥—		MD-1	·01	26HTPN	D	CCD STIMULUS(SXTEU-3)-1(MD)	[ ]
30	—╨—		MD-1	·02	26HTPN	D	CCD STIMULUS(SXTEU-3)-2(MD)	[ ]
8			*BLANK*	·				[ ]
15			*BLANK*	·				[ ]
16			*BLANK*	·				[ ]
17			*BLANK*	·				[ ]
27			*BLANK*	·				[ ]
32			*BLANK*	·				[ ]
33			*BLANK*	·				[ ]
34			*BLANK*	·				[ ]
35			*BLANK*	·				[ ]
36			*BLANK*	·				[ ]
37			*BLANK*	·				[ ]

SXTEU-4 311P10-2P-B-12 (DAM-15P-NMB-K52)

7	T	**TEST**·				CHASSIS GROUND(SXTEU-4)	[]
1	———	FDE-1	·07	26HT	N	DIR FDEA DR A	[]
2	———	FDE-1	·08	26HT	N	EN FDEA DR A	[]
3	———	FDE-1	·06	26HT	N	STEP FDEA DR A	[]
4	———	FDE-2	·07	26HT	N	DIR FDEB DR A	[]
5	———	FDE-2	·08	26HT	N	EN FDEB DR A	[]
6	———	FDE-2	·06	26HT	N	STEP FDEB DR A	[]
9	———	FDE-1	·12	26HT	N	DIR FDEA DR B	[]
10	———	FDE-1	·13	26HT	N	EN FDEA DR B	[]
11	———	FDE-1	·11	26HT	N	STEP FDEA DR B	[]
12	———	FDE-2	·12	26HT	N	DIR FDEB DR B	[]
13	———	FDE-2	·13	26HT	N	EN FDEB DR B	[]
14	———	FDE-2	·11	26HT	N	STEP FDEB DR B	[]
8		*BLANK*	·				[]
15		*BLANK*	·				[]

SXTEU-5 311P10-3P-B-12 (DBM-25P-NMB-K52)

16	T	**TEST**·				CHASSIS GROUND(SXTEU-5)-1	[]
23	T	**TEST**·				CHASSIS GROUND(SXTEU-5)-2	[]
1	———	SXTS-5	·01	26HT	N	FWA P PHOTOTRANS A	[]
2	———	SXTS-5	·02	26HT	N	FWA P PHOTOTRANS B	[]
3	———	SXTS-5	·03	26HT	N	FWA P PHOTOTRANS C	[]
4	———	SXTS-5	·04	26HT	N	FWA S PHOTOTRANS A	[]
5	———	SXTS-5	·05	26HT	N	FWA S PHOTOTRANS B	[]
6	———	SXTS-5	·06	26HT	N	FWA S PHOTOTRANS C	[]
8	———	SXTS-5	·08	26HT	N	FWB P PHOTOTRANS A	[]
9	———	SXTS-5	·09	26HT	N	FWB P PHOTOTRANS B	[]
10	———	SXTS-5	·10	26HT	N	FWB P PHOTOTRANS C	[]
11	———	SXTS-5	·11	26HT	N	FWB S PHOTOTRANS A	[]
12	———	SXTS-5	·12	26HT	N	FWB S PHOTOTRANS B	[]
13	———	SXTS-5	·13	26HT	N	FWB S PHOTOTRANS C	[]
14	———	SXTS-5	·14	26HT	N	5V TO FWA P LEDS	[]
15	———	SXTS-5	·15	26HT	N	CATHODE FWA P LEDS	[]
17	———	SXTS-5	·17	26HT	N	5V TO FWA S LEDS	[]
18	———	SXTS-5	·18	26HT	N	CATHODE FWA S LEDS	[]
19	———	SXTS-5	·19	26HT	N	5V RTN FW P PT	[]
20	———	SXTS-5	·20	26HT	N	5V RTN FW S PT	[]
21	———	SXTS-5	·21	26HT	N	5V TO FWB P LEDS	[]
22	———	SXTS-5	·22	26HT	N	CATHODE FWB P LEDS	[]
24	———	SXTS-5	·24	26HT	N	5V TO FWB S LEDS	[]
25	———	SXTS-5	·25	26HT	N	CATHODE FWB S LEDS	[]
7		*BLANK*	·				[]

SXTEU-6 311P10-2P-B-12 (DAM-15P-NMB-K52)

15		T	**TEST**	·			CHASSIS GROUND(SXTEU-6)	[ ]
1	— ⌠ —	P	SXTS-8	·01	22GKP0	A	TO ASPECT MOTOR M0	[ ]
2	— ⌡ —	P	SXTS-8	·02	22GKP0	A	TO ASPECT MOTOR M1	[ ]
3	— ⌠ —	P	SXTS-8	·03	22GKP0	B	TO ASPECT MOTOR M2	[ ]
4	— ⌡ —	P	SXTS-8	·04	22GKP0	B	TO ASPECT MOTOR M3	[ ]
5	— ⌠ —		SXTS-8	·05	26HTPN	C	LED CONTROL	[ ]
6	— ⌡ —		SXTS-8	·06	26HTPN	C	+5V TO OPTICAL SENSORS	[ ]
7	— ⌠ —		SXTS-8	·07	26HTPN	D	OPEN SENSOR EMITTER	[ ]
8	— ⌡ —		SXTS-8	·08	26HTPN	D	CLOSE SENSOR EMITTER	[ ]
9	— ⌠ —		SXTS-8	·09	26HTPN	E	CCD STIMULUS-1	[ ]
10	— ⌡ —		SXTS-8	·10	26HTPN	E	CCD STIMULUS-2	[ ]
11			*BLANK*	·				[ ]
12			*BLANK*	·				[ ]
13			*BLANK*	·				[ ]
14			*BLANK*	·				[ ]

SXTEU-7 311P10-1P-B-12 (DEM-9P-NMB-K52)

1	— ⌠ —	CCDP-4	·01	26HTPN	A	DCLK+	[ ]
6	— ⌡ —	CCDP-4	·06	26HTPN	A	DCLK-	[ ]
4	— ⌠ —	CCDP-4	·04	26HTPN	B	DATA+	[ ]
9	— ⌡ —	CCDP-4	·09	26HTPN	B	DATA-	[ ]
2		*BLANK*	·				[ ]
3		*BLANK*	·				[ ]
5		*BLANK*	·				[ ]
7		*BLANK*	·				[ ]
8		*BLANK*	·				[ ]

計装配線表

SXTEU-8 311P10-4S-B-12 (DCM-37S-NMB-K52)

1	—⊓—	CCDP-2	·01	26HTPN	A	IMAGE DATA 0+ (LSB)	☐
20	—⊔—	CCDP-2	·20	26HTPN	A	IMAGE DATA 0-	☐
2	—⊓—	CCDP-2	·02	26HTPN	B	IMAGE DATA 1+	☐
21	—⊔—	CCDP-2	·21	26HTPN	B	IMAGE DATA 1-	☐
3	—⊓—	CCDP-2	·03	26HTPN	C	IMAGE DATA 2+	☐
22	—⊔—	CCDP-2	·22	26HTPN	C	IMAGE DATA 2-	☐
4	—⊓—	CCDP-2	·04	26HTPN	D	IMAGE DATA 3+	☐
23	—⊔—	CCDP-2	·23	26HTPN	D	IMAGE DATA 3-	☐
5	—⊓—	CCDP-2	·05	26HTPN	E	IMAGE DATA 4+	☐
24	—⊔—	CCDP-2	·24	26HTPN	E	IMAGE DATA 4-	☐
6	—⊓—	CCDP-2	·06	26HTPN	F	IMAGE DATA 5+	☐
25	—⊔—	CCDP-2	·25	26HTPN	F	IMAGE DATA 5-	☐
7	—⊓—	CCDP-2	·07	26HTPN	G	IMAGE DATA 6+	☐
26	—⊔—	CCDP-2	·26	26HTPN	G	IMAGE DATA 6-	☐
8	—⊓—	CCDP-2	·08	26HTPN	H	IMAGE DATA 7+	☐
27	—⊔—	CCDP-2	·27	26HTPN	H	IMAGE DATA 7-	☐
9	—⊓—	CCDP-2	·09	26HTPN	I	IMAGE DATA 8+	☐
28	—⊔—	CCDP-2	·28	26HTPN	I	IMAGE DATA 8-	☐
10	—⊓—	CCDP-2	·10	26HTPN	J	IMAGE DATA 9+	☐
29	—⊔—	CCDP-2	·29	26HTPN	J	IMAGE DATA 9-	☐
11	—⊓—	CCDP-2	·11	26HTPN	K	IMAGE DATA 10+	☐
30	—⊔—	CCDP-2	·30	26HTPN	K	IMAGE DATA 10-	☐
12	—⊓—	CCDP-2	·12	26HTPN	L	IMAGE DATA 11+ (MSB)	☐
31	—⊔—	CCDP-2	·31	26HTPN	L	IMAGE DATA 11-	☐
13	—⊓—	CCDP-2	·13	26HTPN	M	FRAME GATE+	☐
32	—⊔—	CCDP-2	·32	26HTPN	M	FRAME GATE-	☐
14	—⊓—	CCDP-2	·14	26HTPN	N	WORD SYNC+	☐
33	—⊔—	CCDP-2	·33	26HTPN	N	WORD SYNC-	☐
15	—⊓—	CCDP-2	·15	26HTPN	O	LINE SYNC 1+	☐
34	—⊔—	CCDP-2	·34	26HTPN	O	LINE SYNC 1-	☐
16	—⊓—	CCDP-2	·16	26HTPN	P	LINE SYNC 2+	☐
35	—⊔—	CCDP-2	·35	26HTPN	P	LINE SYNC 2-	☐
17	—⊓—	CCDP-2	·17	26HTPN	Q	LINE SYNC 3+	☐
36	—⊔—	CCDP-2	·36	26HTPN	Q	LINE SYNC 3-	☐
18		*BLANK*	·				☐
19		*BLANK*	·				☐
37		*BLANK*	·				☐

```
SXTEU-9    311P10-3P-B-12 (DBM-25P-NMB-K52)
13          T  **TEST**·                  CHASSIS GROUND(SXTEU-9)-1          [ ]
3   ———————      FDE-1   ·04 26HT N       +5V TO LED ANODES FDE-A            [ ]
6   ———————      FDE-2   ·04 26HT N       +5V TO LED ANODES FDE-B            [ ]
1   — ┌ — P  FDE-1   ·01 22GKP2 A     28V TO FDEA                        [ ]
2   — └ — P  FDE-1   ·09 22GKP0 A     28V RTN FDEA                       [ ]
4   — ┌ — P  FDE-2   ·01 22GKP2 B     28V TO FDEB                        [ ]
5   — └ — P  FDE-2   ·09 22GKP0 B     28V RTN FDEB                       [ ]
14  — ┌ — P  FDE-1   ·10 22GKP2 C     +15V RELAY POWER FDE-A             [ ]
15  — ┼ — P  FDE-1   ·03 22GKP0 C     RELAY COM-SEL FDEA FWA DR A        [ ]
21  — └ — P  FDE-1   ·02 22GKP0 C     RELAY COM-SEL FDEA FWB DR B        [ ]
17  — ┌ — P  FDE-2   ·10 22GKP2 D     +15V RELAY POWER FDE-B             [ ]
18  — ┼ — P  FDE-2   ·03 22GKP0 D     RELAY COM-SEL FDEB FWA DR A        [ ]
24  — └ — P  FDE-2   ·02 22GKP0 D     RELAY COM-SEL FDEB FWB DR B        [ ]
7                *BLANK* ·                                                   [ ]
8                *BLANK* ·                                                   [ ]
9                *BLANK* ·                                                   [ ]
10               *BLANK* ·                                                   [ ]
11               *BLANK* ·                                                   [ ]
12               *BLANK* ·                                                   [ ]
16               *BLANK* ·                                                   [ ]
19               *BLANK* ·                                                   [ ]
20               *BLANK* ·                                                   [ ]
22               *BLANK* ·                                                   [ ]
23               *BLANK* ·                                                   [ ]
25               *BLANK* ·                                                   [ ]

SXTEU-10   311P10-2P-B-12 (DAM-15P-NMB-K52)
13          T  **TEST**·                  CHASSIS GROUND(SXTEU-10)-1         [ ]
5   ———————      CCDP-1  ·05 26HT N       MONITOR RELAY COMMON               [ ]
6   ———————      CCDP-1  ·06 26HT N       DAY/NIGHT RELAY (DAY-CLOSE)        [ ]
7   ———————      CCDP-1  ·07 26HT N       TEC RELAY (CLOSE-TEC ACTIVE)       [ ]
14  ———————      CCDP-1  ·14 20GK 0       CCDP SECONDARY RTN                 [ ]
1   — ┌ — P  CCDP-1  ·01 22GKP2 A     28V TO CCD PDU-1                   [ ]
15  — └ — P  CCDP-1  ·15 22GKP0 A     28V RTN-2(SXT)                     [ ]
2   — ┌ — P  CCDP-1  ·02 22GKP2 B     15V TO TEC RELAY                   [ ]
3   — ┼ — P  CCDP-1  ·03 22GKP0 B     TEC ARM PULSE RESET                [ ]
11  — └ — P  CCDP-1  ·11 22GKP0 B     TEC ARM PULSE SET                  [ ]
4   — ┌ — P  CCDP-1  ·04 22GKP0 C     NIGHT PWR ARM RESET                [ ]
10  — ┼ — P  CCDP-1  ·10 22GKP2 C     15V NIGHT RELAY                    [ ]
12  — └ — P  CCDP-1  ·12 22GKP0 C     NIGHT PWR ARM SET                  [ ]
8   — ┌ — P  CCDP-1  ·08 22GKP2 D     28V TO CCD PDU-2                   [ ]
9   — └ — P  CCDP-1  ·09 22GKP0 D     28V RTN-1(SXT)                     [ ]
```

```
SXTEU-11  311P10-3P-B-12 (DBM-25P-NMB-K52)
16          T **TEST**·                  CHSSIS GROUND P ENCODERS            []
20          T **TEST**·                  CHASSIS GROUND S ENCODERS-2         []
24          T **TEST**·                  CHASSIS GROUND MOTOR-1              []
1   ———————   SXTS-1  ·01 26HT N         PTA-P                               []
2   ———————   SXTS-1  ·02 26HT N         PTB-P                               []
3   ———————   SXTS-1  ·03 26HT N         PTC-P                               []
4   ———————   SXTS-1  ·04 26HT N         PTD-P                               []
5   ———————   SXTS-1  ·05 26HT N         PTE-P                               []
6   ———————   SXTS-1  ·06 26HT N         PTA-S                               []
7   ———————   SXTS-1  ·07 26HT N         PTB-S                               []
8   ———————   SXTS-1  ·08 26HT N         PTC-S                               []
9   ———————   SXTS-1  ·09 26HT N         PTD-S                               []
10  ———————   SXTS-1  ·10 26HT N         PTE-S                               []
14  ———————   SXTS-1  ·14 26HT N         5V TO 3LED P ANODE                  []
15  ———————   SXTS-1  ·15 26HT N         LED P CATHODE                       []
17  ———————   SXTS-1  ·17 26HT N         5V RTN P ENCODER                    []
18  ———————   SXTS-1  ·18 26HT N         5V TO 2LED P ANODE                  []
19  ———————   SXTS-1  ·19 26HT N         5V RTN S ENCODER                    []
21  ———————   SXTS-1  ·21 26HT N         5V TO 3LED S ANODE                  []
22  ———————   SXTS-1  ·22 26HT N         LED S CATHODE                       []
23  ———————   SXTS-1  ·23 26HT N         5V TO 2LED S ANODE                  []
12  —┬—  P    SXTS-1  ·12 22GKP0 A       MOTOR PHASE A                       []
13  —┼—  P    SXTS-1  ·13 22GKP0 A       MOTOR PHASE B                       []
25  —┴—  P    SXTS-1  ·25 22GKP0 A       MOTOR PHASE C                       []
11            *BLANK* ·                                                      []
```

```
SXTS-1     311P10-3S-B-12 (DBM-25S-NMB-K52)
[16]          T **TEST**·                    CHASSIS GROUND P ENCODERS-3    []
[20]          T **TEST**·                    CHASSIS GROUND S ENCODERS-4    []
[24]          T **TEST**·                    CHASSIS GROUND MOTOR-2         []
[1 ] ———————    SXTEU-11·01 26HT N           PTA-P                          []
[2 ] ———————    SXTEU-11·02 26HT N           PTB-P                          []
[3 ] ———————    SXTEU-11·03 26HT N           PTC-P                          []
[4 ] ———————    SXTEU-11·04 26HT N           PTD-P                          []
[5 ] ———————    SXTEU-11·05 26HT N           PTE-P                          []
[6 ] ———————    SXTEU-11·06 26HT N           PTA-S                          []
[7 ] ———————    SXTEU-11·07 26HT N           PTB-S                          []
[8 ] ———————    SXTEU-11·08 26HT N           PTC-S                          []
[9 ] ———————    SXTEU-11·09 26HT N           PTD-S                          []
[10] ———————    SXTEU-11·10 26HT N           PTE-S                          []
[14] ———————    SXTEU-11·14 26HT N           5V TO 3LED P ANODE             []
[15] ———————    SXTEU-11·15 26HT N           LED P CATHODE                  []
[17] ———————    SXTEU-11·17 26HT N           5V RTN P ENCODER               []
[18] ———————    SXTEU-11·18 26HT N           5V TO 2LED P ANODE             []
[19] ———————    SXTEU-11·19 26HT N           5V RTN S ENCODER               []
[21] ———————    SXTEU-11·21 26HT N           5V TO 3LED S ANODE             []
[22] ———————    SXTEU-11·22 26HT N           LED S CATHODE                  []
[23] ———————    SXTEU-11·23 26HT N           5V TO 2LED S ANODE             []
[12] — ┬┬ — P SXTEU-11·12 22GKP0 A           MOTOR PHASE A                  []
[13] — ┼┼ — P SXTEU-11·13 22GKP0 A           MOTOR PHASE B                  []
[25] — ┘└ — P SXTEU-11·25 22GKP0 A           MOTOR PHASE C                  []
[11]            *BLANK* ·                                                   []

SXTS-2     ST 11964-9-T26(P)
[3 ]          T **TEST**·                    SPARE(SXTS-2)                  []
[2 ] ———————    CCDE-2   ·02                 PPAR                           []
[4 ] ———————    CCDE-2   ·04                 TRANSFER GATE                  []
[6 ] ———————    CCDE-2   ·06                 PSUM                           []
[5 ] — ┬┬ —     CCDE-2   ·05 P        A      TEC CONTROL (+)                []
[9 ] — ┘└ —     CCDE-2   ·09 P ·      A      TEC CONTROL RETURN (-)         []
[1 ] — ┼ —      CCDE-2   ·01 S          08   PSERIAL                        []
[7 ] — ┼ —      CCDE-2   ·07 S          08   RESET(SXT)                     []
[8 ] — ┘        CCDE-2   ·08            08   CHASSIS GROUND(CCDE-SXTS)      []

SXTS-3     ST 11965-9-T26(S)
[9 ]          T **TEST**·                    SPEARE(SXTS-3)                 []
[3 ] — ┬┬ —     CCDE-3   ·03 P        B      +15V SIG CHAIN                 []
[4 ] — ┼┼ —     CCDE-3   ·04 P        B      -15V SIG CHAIN-2               []
[8 ] — ┘└ —     CCDE-3   ·08 P        B      +/-15V RTN-2                   []
[5 ] — ┬┬ —     CCDE-3   ·05 P        C      T1 TEC CJ TEMP                 []
[7 ] — ┘└ —     CCDE-3   ·07 P        C      T2 CCD CJ TEMP REN             []
[1 ] — ┬┬ ┬┬    CCDE-3   ·01 T        A 02   VIDEO                          []
[6 ] — ┼┘ └┘    CCDE-3   ·06 T        A 02   VIDEO RTN                      []
[2 ] — ┘        CCDE-3   ·02            02   VIDEO SHIELD                   []
```

```
SXTS-4     311P10-1S-B-12 (DEM-9S-NMB-K52)
 1  —╥— P FDE-3    ·01 22GKP0 A    FWA MOTOR PH A                   []
 2  —╫— P FDE-3    ·02 22GKP0 A    FWA MOTOR PH B                   []
 6  —╨— P FDE-3    ·06 22GKP0 A    FWA MOTOR PH C                   []
 4  —╥— P FDE-3    ·04 22GKP0 B    FWB MOTOR PH A                   []
 5  —╫— P FDE-3    ·05 22GKP0 B    FWB MOTOR PH B                   []
 9  —╨— P FDE-3    ·09 22GKP0 B    FWB MOTOR PH C                   []
 3          *BLANK* ·                                               []
 7          *BLANK* ·                                               []
 8          *BLANK* ·                                               []

SXTS-5     311P10-3S-B-12 (DBM-25S-NMB-K52)
16        T **TEST**·              CHASSIS GROUND(SXTS-5)-1         []
23        T **TEST**·              CHASSIS GROUND(SXTS-5)-2         []
 1  ———————— SXTEU-5 ·01 26HT N    FWA P PHOTOTRANS A               []
 2  ———————— SXTEU-5 ·02 26HT N    FWA P PHOTOTRANS B               []
 3  ———————— SXTEU-5 ·03 26HT N    FWA P PHOTOTRANS C               []
 4  ———————— SXTEU-5 ·04 26HT N    FWA S PHOTOTRANS A               []
 5  ———————— SXTEU-5 ·05 26HT N    FWA S PHOTOTRANS B               []
 6  ———————— SXTEU-5 ·06 26HT N    FWA S PHOTOTRANS C               []
 8  ———————— SXTEU-5 ·08 26HT N    FWB P PHOTOTRANS A               []
 9  ———————— SXTEU-5 ·09 26HT N    FWB P PHOTOTRANS B               []
10  ———————— SXTEU-5 ·10 26HT N    FWB P PHOTOTRANS C               []
11  ———————— SXTEU-5 ·11 26HT N    FWB S PHOTOTRANS A               []
12  ———————— SXTEU-5 ·12 26HT N    FWB S PHOTOTRANS B               []
13  ———————— SXTEU-5 ·13 26HT N    FWB S PHOTOTRANS C               []
14  ———————— SXTEU-5 ·14 26HT N    5V TO FWA P LEDS                 []
15  ———————— SXTEU-5 ·15 26HT N    CATHODE FWA P LEDS               []
17  ———————— SXTEU-5 ·17 26HT N    5V TO FWA S LEDS                 []
18  ———————— SXTEU-5 ·18 26HT N    CATHODE FWA S LEDS               []
19  ———————— SXTEU-5 ·19 26HT N    5V RTN FW P PT                   []
20  ———————— SXTEU-5 ·20 26HT N    5V RTN FW S PT                   []
21  ———————— SXTEU-5 ·21 26HT N    5V TO FWB P LEDS                 []
22  ———————— SXTEU-5 ·22 26HT N    CATHODE FWB P LEDS               []
24  ———————— SXTEU-5 ·24 26HT N    5V TO FWB S LEDS                 []
25  ———————— SXTEU-5 ·25 26HT N    CATHODE FWB S LEDS               []
 7           *BLANK* ·                                              []
```

SXTS-6 311P10-3S-B-12 (DBM-25S-NMB-K52)

✓	3		HK-9	·07	26GKP9	A	TL-40 (SXT MTT)		[]
	4		HK-9	·08	26GKP9	A	TL-40RTN (SXT MTT)		[]
✓	5		HK-9	·09	26GKP9	B	TL-41 (SXT ATT)	Front end ?	[]
	6		HK-9	·10	26GKP9	B	TL-41RTN (SXT ATT)		[]
✓	7		HK-9	·11	26GKP9	C	TL-42 (SXT MRT)		[]
	8		HK-9	·12	26GKP9	C	TL-42RTN (SXT MRT)		[]
✓	9		HK-9	·13	26GKP9	D	TL-43 (SXT FW2T)		[]
	10		HK-9	·14	26GKP9	D	TL-43RTN (SXT FW2T)		[]
✓	11		HK-9	·15	26GKP9	E	TL-44 (SXT FW1T)		[]
	12		HK-9	·16	26GKP9	E	TL-44RTN (SXT FW1T)		[]
✓	13		HK-9	·17	26GKP9	F	TL-45 (SXT STRT)		[]
	14		HK-9	·18	26GKP9	F	TL-45RTN (SXT STRT)		[]
✓	15		HK-9	·20	26GKP9	G	TL-46 (SXT TSAT)		[]
	16		HK-9	·21	26GKP9	G	TL-46RTN (SXT TSAT)		[]
✓	17		HK-9	·22	26GKP9	H	TL-47 (SXT TECT)		[]
	18		HK-9	·23	26GKP9	H	TL-47RTN (SXT TECT)		[]
✓	19		HK-9	·24	26GKP9	I	TL-48 (SXT CCDHT)		[]
	20		HK-9	·25	26GKP9	I	TL-48RTN (SXT CCDHT)		[]
✓	21		HCE-1	·29	26HTPN	J	10THERMAL STRAP SENSOR		[]
	22		HCE-1	·11	26HTPN	J	10THERMAL STRAP SENSOR RTN		[]
✓	23	P	HCE-2	·26	22GKP2	K	THERMAL STRAP HEATER(PLUS)		[]
	24	P	HCE-2	·27	22GKP0	K	THERMAL STRAP HEATER(MINUS)		[]
	1		*BLANK*	·					[]
	2		*BLANK*	·					[]
	25		*BLANK*	·					[]

SXTS-7 311P409-1S-B-12

1	T	**TEST**·	ASPECT TELESCOPE CELL TEMP-1	[]
2	T	**TEST**·	ASPECT TELESCOPE CELL TEMP-2	[]
3	T	**TEST**·	MIRROR ASSY MOUNT TEMP	[]
4	T	**TEST**·	MIRROR ASSY MOUNT TEMP	[]
5		*BLANK* ·		[]
6		*BLANK* ·		[]
7		*BLANK* ·		[]
8		*BLANK* ·		[]
9		*BLANK* ·		[]

```
SXTS-8    311P10-2S-B-12 (DAM-15S-NMB-K52)
[15]       T **TEST**·                      CHASSIS GROUND(SXTS-8)         []
[1] -╥-  P SXTEU-6  ·01 22GKP0 A     TO ASPECT MOTOR M0             []
[2] -╨-  P SXTEU-6  ·02 22GKP0 A     TO ASPECT MOTOR M1             []
[3] -╥-  P SXTEU-6  ·03 22GKP0 B     TO ASPECT MOTOR M2             []
[4] -╨-  P SXTEU-6  ·04 22GKP0 B     TO ASPECT MOTOR M3             []
[5] -╥-    SXTEU-6  ·05 26HTPN C     LED CONTROL                    []
[6] -╨-    SXTEU-6  ·06 26HTPN C     +5V TO OPTICAL SENSORS         []
[7] -╥-    SXTEU-6  ·07 26HTPN D     OPEN SENSOR EMITTER            []
[8] -╨-    SXTEU-6  ·08 26HTPN D     CLOSE SENSOR EMITTER           []
[9] -╥-    SXTEU-6  ·09 26HTPN E     CCD STIMULUS-1                 []
[10] -╨-   SXTEU-6  ·10 26HTPN E     CCD STIMULUS-2                 []
[11]       *BLANK*  ·                                               []
[12]       *BLANK*  ·                                               []
[13]       *BLANK*  ·                                               []
[14]       *BLANK*  ·                                               []

SXTS-10   311P10-1S-B-12 (DEM-9S-NMB-K52)
[1] -╥-    HCE-1    ·09 26HTPN A     FPG HEATER SENSOR              []
[2] -╨-    HCE-1    ·27 26HTPN A     FPG HEATER SENSOR RTN          []
[3] -╥-  P HCE-2    ·24 22GKP2 B     FPG HEATER(PLUS)               []
[4] -╨-  P HCE-2    ·32 22GKP0 B     FPG HEATER(MINUS)              []
[5]        *BLANK*  ·                                               []
[6]        *BLANK*  ·                                               []
[7]        *BLANK*  ·                                               []
[8]        *BLANK*  ·                                               []
[9]        *BLANK*  ·                                               []

SXTS-11   311P10-1S-B-12 (DEM-9S-NMB-K52)
[1] -╥-    HCE-1    ·08 26HTPN A     OBJ HEATER SENSOR              []
[2] -╨-    HCE-1    ·26 26HTPN A     OBJ HEATER SENSOR RTN          []
[3] -╥-  P HCE-2    ·05 22GKP2 B     OBJ HEATER(PLUS)               []
[4] -╨-  P HCE-2    ·13 22GKP0 B     OBJ HEATER(MINUS)              []
[5]        *BLANK*  ·                                               []
[6]        *BLANK*  ·                                               []
[7]        *BLANK*  ·                                               []
[8]        *BLANK*  ·                                               []
[9]        *BLANK*  ·                                               []
```

APPENDIX M

SXT HANDLING AND OPERATING REQUIREMENTS AND PROCEDURE

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SXT Handling and Operating Requirements and Procedure

Version 1.00
Prepared by M.Morrison
29-May-90
Revised by M. Finch
15-Sep-90

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CONTENTS

CHAPTER 7 OPERATING SXT DURING TESTING PRECAUTIONS

CHAPTER 8 RED TAG ITEMS

CHAPTER 1

INTRODUCTION

The following document is written to establish requirements, guidelines, and procedures for the operation, handling, and storage of the Soft X-Ray Telescope (SXT) while in Japan.

CHAPTER 2

GENERAL PRECAUTIONS

2.1 Warning Signs -

All personnel entering areas where SXT flight hardware is located should understand that flight hardware is present. It is suggested that signs in both Japanese and English warning of this be posted adjacent to the hardware. The flight hardware is sensitive to electro-static discharge and care should be taken to ensure that all operations with the hardware are performed using ground straps as appropriate.

2.2 Shipping Inspection -

SXT should not be exposed to environments other than a clean laboratory at any time unless special precautions are taken to maintain cleanliness of the instrument. Special precautions should be taken to insure that the SXT is not exposed during the airport and customs procedure.

CHAPTER 3

HANDLING AND ASSEMBLY PRECAUTIONS

3.1 Clean Room Environment -

SXTS is not to be disassembled in an environment lower than a Class 10,000 clean room. For working on the objective group or the focal plane group the use of a Class 1000 or better clean bench is required. Special approval of LPARL is required for any disassembly of SXT. Disassembly shall only be performed under the supervision of LPARL personnel, and any disassembly requires notification of the LPARL Quality Engineer.

There shall be a minimum of 35% humidity any time the electrical configuration of ESD sensitive hardware is changed (connecting, disconnecting, cabling, installation, etc.) The hardware can be operated at lower humidity levels. If the electrical configuration requires alteration, it should only be performed by personnel who are wearing proper ground straps.

All SXT hardware (SXT-S, SXTE-U, FDE, and CCDE/P) should be handled on properly grounded anti-static mats. Hardware should be stored in anti-static bags when not being used.

3.2 Garments For Personnel -

Clean room garments (smocks, gloves, caps) are to be worn when handling SXT flight hardware. Garments acceptable for use in microelectronics manufacturing are acceptable to SXT. Conductive gowns must be used for ESD safety.

3.3 ESD Protection -

Grounding straps are to be worn when connecting or disconnecting SXT harness or handling the SXT-S when the camera is mounted on the SXT-S.

Before installing the CCDH to the SXT-S, use the terminating plugs on the CCDH cable and connect the terminating wire to the SXT-S.

The SXTE-U, CCDE/P, and FDE boxes will be transported from one location to another in approved ESD containers.

ESD warning labels will be affixed on the hardware and shipping containers. All non-electrically isolated test equipment, used in conjunction with SXT electronics hardware, will be connected to a verifiable earth ground.

3.4 Cabling -

Cable between CCDH and CCDE/P is not to be disconnected without specific approval by LPARL. Normally this will only be done by Lockheed or JPL personnel.

The cables that are attached to CCDH should not be removed. If the CCDP/E end of the cable is disconnected for and reason, a shorting plug provided by JPL should be installed at the end of the cable.

3.5 SXT-S Installation Into The Spacecraft -

The protective cover over the objective group should be in place when the crane is used to lift the SXT-S into the spacecraft. Care should be taken to avoid touching or crushing the thermal blankets during the mounting operation of SXT to the spacecraft.

Chapter 8 in the EICA is referenced for installation operations.

3.6 Removing Spacecraft Blankets -

The spacecraft blankets are held on by velcro which produce a large number of particles when removed. Whenever removing the spacecraft blankets a vacuum cleaner hose should be held at the peel point.

3.7 SXT Blankets And Taped Surfaces -

Unnecessary touching of SXT thermal blankets and surfaces is to be avoided. Care shall be taken to avoid crushing SXT thermal blankets.

3.8 Storage At The End Of The Day -

See the "Storage Conditions" section for requirements on how to leave the hardware when finished for the day.

3.9 Assembly Check List -

3.9.1 Environment -

____ 1. Confirm all personnel handling the hardware are wearing ground straps.

____ 2. Confirm that the SXT-S is grounded (to the FPG support.)

____ 3. Confirm that the humidity is greater than 35% (before cabling the camera.)

3.9.2 Guide For Assembly Of CCDH To SXT-S -

____ 1. Disconnect the CCDH from the CCDE. Install the terminating plugs right away. Connect the wire on the terminating plug to the FPG ground point.

____ 2. Confirm that the CCD slide is in the camera spacer (and has a window installed in the slide.)

____ 3. Mount the camera spacer to the FPG.

____ 4. Mount the CCDH to the spacer with the insulation washers between the CCDH and the spacer. Insure that the slide can be removed (that the screw length is not too long.)

____ 5. Temporarily disconnect the ground wire going to the CCDH terminator at the FPG grounding point. Check the electrical isolation between

SXT-S and CCDH (it should demonstrate an open circuit.) Check the electrical isolation between SXT-S and the thermal strap (it should demonstrate an open circuit.) Connect the CCDH terminator ground wire to the FPG grounding point.

CHAPTER 4

STORAGE CONDITIONS

4.1 Storage Environment -

SXT should not be exposed to other than a clean laboratory environment at any time unless special precautions are taken to maintain cleanliness of the instrument.

SXT should not be stored for extended periods where the relative humidity is above 60% or below 20%.

When possible, place the SXT near one of the out flow of the clean room filtering system.

SXT flight hardware should always be secured in some way to minimize possibility of damage in the event of an earthquake from falling off tables, etc.

SXT hardware should only be stored in the metallic (green) anti-static bags. The pink anti-static bags should not be used.

4.2 Connectors -

All unused connectors must have protective caps at all times.

4.3 Camera Slide -

The camera contamination slide is to remain in place unless specific approval is granted by LPARL.

4.4 Nitrogen Purge -

After delivery GN2 purge will be maintained whenever possible to protect filters and metering tube from humidity and air borne contamination.

4.5 Objective Group Cover -

Whenever possible, the objective group cover should be installed on the SXTS.

CHAPTER 5

SPACECRAFT AND OTHER INSTRUMENTS

5.1 Cleanliness -

The spacecraft and all other Solar-A subsystems and instruments should be cleaned to remove particles and volatiles before installation on the spacecraft. After cleaning they should be bagged for moving or handling prior to installation. After cleaning they should be handled with gloves.

Cleaning of other subsystems or the spacecraft should not be done in the vicinity of SXT.

Vacuum bakeout of the spacecraft structure (panels), thermal blankets and harnesses should be performed.

CHAPTER 6

TESTING ENVIRONMENTS AND CLEAN ROOM

6.1 Equipment Operation -

Operation of electrically noisy AC equipment (vacuum cleaners, hot air blowers, electric drills, etc.) should not be operated in the vicinity (within approx. 1 meter) of the CCD camera.

Chapter 8 of the EICA should be followed in the operation of the GSE during bench testing of the SXT.

Chapter 8 of the EICA should be followed in the operation of the Gaseous Nitrogen Purge System.

6.2 Maintaining The Clean Room -

When possible, minimize the quantity of pens and paper in the clean room as well as the number of people.

Shipping containers (especially those made of untreated wood) should not be brought into the clean room. Hardware should be unpacked in the ante-room, cleaned, and brought into the clean room.

6.3 ISAS Thermal Vacuum Chamber Preparation -

Vacuum bakeout of the ISAS thermal vacuum chamber and all shrouds, cables heaters, etc. to be used in the chamber during the Solar-A thermal vacuum testing.

6.4 Monitor The Clean Room -

LPARL will monitor the cleanliness of the spacecraft assembly clean room when possible. The following tests will be performed:

a. Optical witness samples (for condensible contamination)
b. Particle fall out samples
c. Tape lift tests
d. Laser particle counter

CHAPTER 7

OPERATING SXT DURING TESTING PRECAUTIONS

7.1 TEC Operation -

The TEC is not to be operated for more than 30 seconds at any time unless the CCDH is in a vacuum or dry N2 atmosphere to prevent condensation on the CCD.

7.2 Simple Running Of SXT -

Chapter 8 of the EICA should be followed for the operation of the SXT during testing.

CHAPTER 8

RED TAG ITEMS

The following items are red tag items and must be removed before flight. As red tag items they are present to protect aspects of the instrument and thus should be removed as late as possible before launch.

1. Camera Slide - This is the step that removes the protective cover in front of the CCD Camera.
2. GN2 purge line - This line connects into SXTS via the Camera Slide. Removal of the line should coincide with the removal of the camera slide.
3. Protective OBJ Entrance Cover - This is the cover that keeps contaminants off of the face of SXTS.
4. Witness mirrors in OBJ mirror cavity - If these are present, they should be removed at this time, and closure covers installed.
5. Witness samples of the Metering Tube - These moisture monitoring devices should be removed at this time.

Note: The optical alignment mirror should have been removed after the last optical alignment check. The open unused test connectors should have protective covers in place prior to final red tag removal time.

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