EPI-Hi

Harness Specification

Revision B

January 21, 2014

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Approval Signatures

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Document Revision Record

Rev.	Date	Description of Change	Approved
Draft #1	June 7, 2011	Initial draft	
Draft #2	Mar 14, 2012	Updated harness diagram with reversed flex cable origins, they now originate from DPU Board	
-	Nov 26, 2013	Added telescope connector pinouts to Section 6.	Rick Cook
A	Dec 17, 2013	Updated harness diagrams, added cavity for guide pins to LET/HET-P2 pinouts, clarified locations of connectors in tables of Section 5.	Rick Cook
B	Jan 21, 2014	Added AGND pins to thick detector mates.	Rick Cook

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1. Introduction

The Energetic Particles Instrument for High Energy (EPI-Hi), part of ISIS suite of cosmic-ray instruments on Solar Probe Plus spacecraft, comprises two Low Energy Telescopes (LET1 and LET2), High Energy Telescope (HET), and supporting electronics as shown in the block diagram below (Figure 1-1).

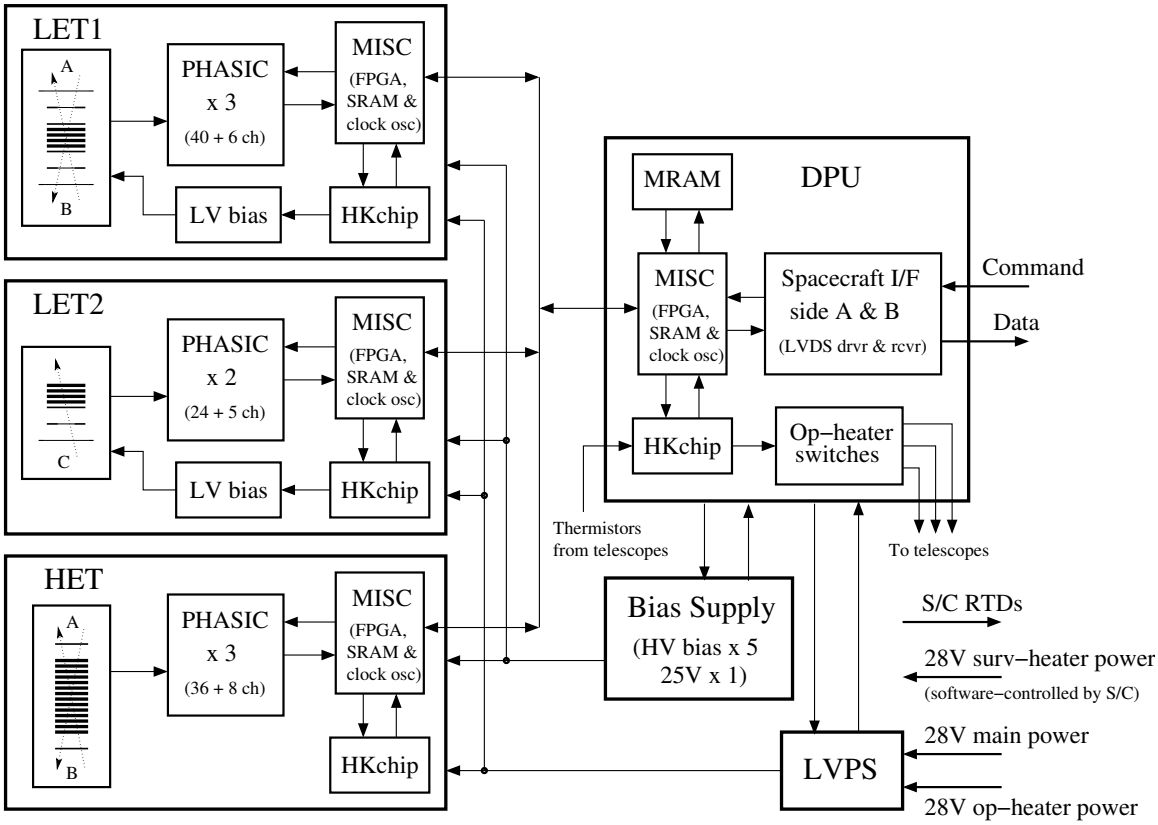

Figure 1-1 EPI-Hi Block Diagram

This document specifies design requirements for the internal and external EPI-Hi harnesses. Additionally, in conjunction with reference documents 7 and 8 listed in Section 1.2, this document serves as the EPI-Hi Electronics Interface Control Document.

The three EPI-Hi telescopes are extremely sensitive to electronic noise, and every effort must be made to make EPI-Hi subsystem interconnections as quiet as possible. EPI-Hi instrument is very constrained in terms of mass and power, so special attention must be paid to optimizing the use of these resources in the design and fabrication of the EPI-Hi harnesses.

Current schedule for harness design, fabrication and test is as follows:

Start design work on EM harness	June 7, 2011
Testing of the EM harness	Jan. 15, 2014 – Dec. 1, 2014
Start work on the flight harness	Mar. 1, 2015
Testing of the flight harness	June 1 – Mar 30, 2016

Above dates are subject to change; all parties shall strive to beat the current schedule by about two months in order to keep the Earned Value parameters in good shape.

Other important Project milestones:

EPI-Hi Preliminary Design Review	Nov. 5-6, 2013
EPI-Hi Critical Design Review	Jan. 13-14, 2015

1.1 *Document Conventions*

In this document the acronym TBD (to be determined) means that no data currently exists. A value followed by TBR (to be resolved) means that it is preliminary. In either case, they may be followed by institution name indicating who is responsible for providing the data.

1.2 *Applicable Documents*

The following reference documents shall apply in the design, fabrication and testing of the EPI-Hi LVPS. It is assumed that they will be available on SwRI Wiki site or APL SPP SharePoint site in due time.

1. NASA EEE-INST-002: Instructions for EEE Parts Selection, Screening, Qualification and Derating
2. 7434-9040 SPP Electromagnetic Environment Control Plan
3. 7434-9066 SPP General Instrument ICD
4. 7434-9058 ISIS to Spacecraft ICD
5. 7434-9039 SPP Environmental Design and Test Requirements Document
6. SPP safety and mission assurance requirements
7. SPP-CIT-001 EPI-Hi LVPS Requirements Document
8. SPP-CIT-002 EPI-Hi Bias Supply Requirements Document

2. Harness Diagrams

EPI-Hi harness diagram is shown below (Figure 2-1). Harness routing and connector polarity have been optimized with respect to the voltage rating and physical size. For clarity, telescope connectors and the thermal hardware are not shown in great detail on this diagram.

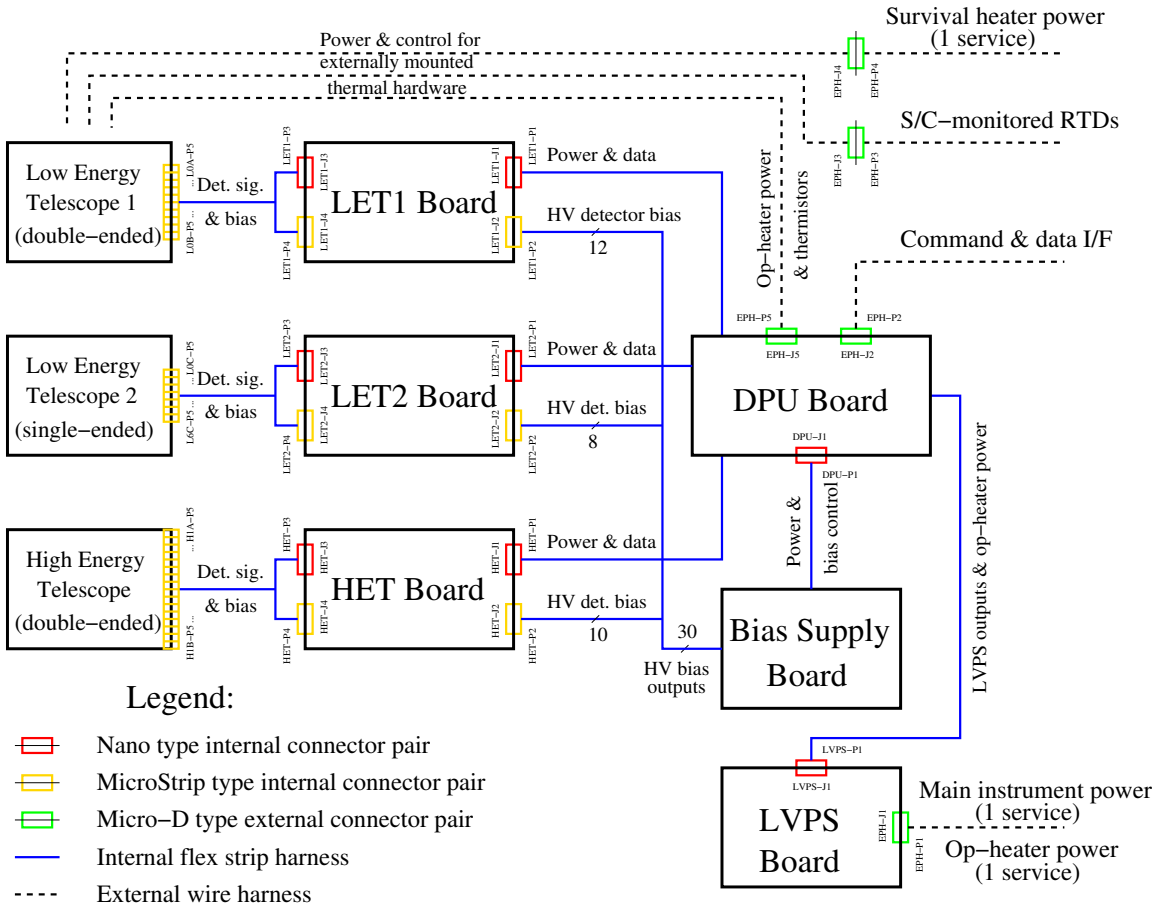

Figure 2-1 EPI-Hi Harness Diagram

EPI-Hi thermal harness diagram is shown in detail below (Figure 2-2). Connector reference designators listed in the Legend match the harness diagram on the previous page. Thermal harness assembly and installation of all thermal hardware shown below, including the S/C RTDs, will be done at Caltech by experienced harness technicians from JPL.

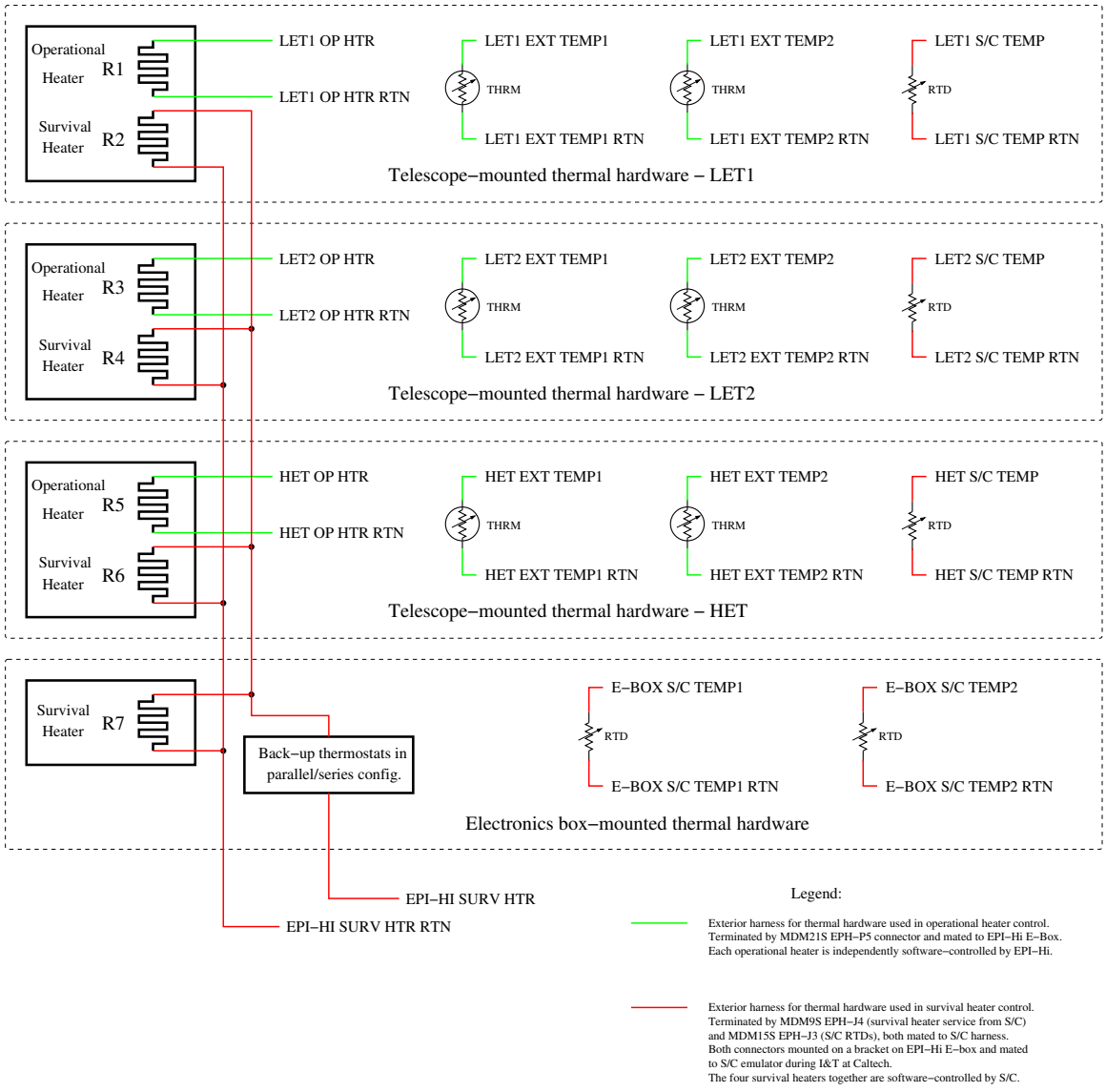

Figure 2-2 EPI-Hi Thermal Harness Diagram

3. Wire Types

In all sections of this document the following wire nomenclature shall apply:
- #24, #26 and #28 AWG are stranded, silver-coated copper wires with white or off-white insulation unless otherwise noted. Rare exceptions to this wire type can be found in some pigtail wire from heaters and thermistors. These exceptions are labeled #24∑, #26π, #28Δ, etc. Wire physical properties and tensile strength requirements are summarized below. Datasheets with details of wire construction are in Appendix 1.
- In order to reduce mass and stiffness, most harness wires shall have 0.0025" Tefzel construction.
- SC is a single conductor wire (note that it is stranded, not a solid wire).
- TP is a twisted pair, no shield or jacket (just two wires twisted together), one twist per inch.
- TPS is a twisted pair shielded with ¼" wide EMI tape wrapped with 50% overlap (i.e., two layers). On top of EMI tape there shall be ¼" wide Kapton tape, also wrapped with 50% overlap.
- TQ is a twisted quad (4-wire group), no shield or jacket, one twist per inch.
- TQS is a twisted quad shielded with EMI/Kapton tape as described above, one twist per inch.

3.1 *Wire Part Numbers and Properties*

Summary of the main wire properties is shown below. For the complete datasheets see Appendix 1.

Wire Gauge and Type	Thermax Part No.	Conductor Diameter mm (inch)	Insulation Diameter mm (inch)	Characteristic Resistance Ω/m (Ω/1000ft)	Characteristic Mass g/m (lb/1000ft)
#24 SC	SMLDx24	0.60 (0.0235)	0.81 (0.032)	0.08 (23.6)	2.68 (1.8)
#26 SC	SMLDx26	0.48 (0.0189)	0.69 (0.027)	0.12 (37.3)	1.93 (1.3)
#28 SC	SMLDx28	0.38 (0.015)	0.58 (0.023)	0.21 (63.8)	1.16 (0.78)

Tensile requirements for pure copper wire shown below shall be used in pull-test of crimped contacts.

Wire Gauge	Tensile Requirement
#24	7.2 lbs
#26	4.8 lbs
#28	3 lbs

4. Harness Shielding and Termination

Each harness shall have a common outer shield (over-shield) tied to chassis ground at both ends via connector backshell. All inner shields (used on twisted shielded pairs and quads) shall be terminated this way as well, except for LVDS lines whose shields will be grounded only on the source end (either the Spacecraft end or the Instrument end).
The shield termination is specifically noted in Section 6.
The inner-shields shall be made of EMI tape (High-Flex Conductive Fiber Shielding Tape) overwrapped with Kapton tape (two layers, i.e., 50% overlap of each tape shall be used). They shall be pre-installed on the wires provided by Caltech.

4.1 *EMI Tape*

EMI tape is made by Laird Technologies (www.lairdtech.com) and shall be supplied by Caltech in 0.25" and 0.375" widths for wrapping of inner shields and over-shields.

4.2 *Harness Braid*

For the over-shields on external harness the following braid shall be used: TBD (APL)

4.3 *Backshells*

For MDM connectors use either aluminum or EMI composite backshells made of Ultem 2300 and plated with electroless nickel, both manufactured by Glenair, Inc. (www.glenair.com). Caltech shall supply all backshells and associated hardware for the intra-instrument harnesses.

Backshell entry shape nomenclature in this text is as follows:
RT Round, Top Entry
ET Elliptical, Top Entry
RA Round, Angled Entry (45º)
RS Round, Side Entry (90º)

4.4 *Harness Tie-downs*

Harness tie-down points on the EPI-Hi box and telescopes shall not interfere with telescopes' fields of view (FoV). The tie-down hardware and stand-offs shall be of the type manufactured by Click Bond, Inc. and provided by Caltech.

Harness tie-down P/Ns and measured unit masses are as follows:
CB9120V5 2.0 g
CB9151V5 1.6 g
CB9302V3 0.4 g

5. Connector Types

Harness connectors, their mates, backshells, and types of mounting are described below.
The following notation is used:

- MDM is Micro-D connector per MIL-DTL-83513.

- Nano is Glenair Series 89 Nanominiature connector per MIL-DTL-32139.

- MicroStrip is Glenair Series 171 single-row connector with Micro-D contacts per MIL-DTL-83513.

Female MicroStrip connectors have a guide pin on each end, while male ones have cavities for mating with guide pins. Only the number of actual electrical contacts and guide pins is listed in the connector description of MicroStrip connectors, e.g., MicroStrip 10S has 8 electrical socket contacts and 2 guide pins, not counting the extra cavities for mounting holes.

- TH is through-hole mount connector on PCB or rigidizer tab at the end of flex strip.

PCB and rigidizer tab thickness is typically 0.062” (1.5 mm).

- SM is surface-mount connector on PCB.

- DB is duck-bill connector mounted directly on flex strip (no rigidizer tab).

Connector type is defined by terms “pin” (P) and “socket” (S). Example: Nano 25S is a 25-socket (female).

By convention, harness connector on the free end has P in its reference designator, while its mate that is typically mounted on a box or a bracket carries J in its reference designator.

5.1 *S/C Interface Connector Types*

Harness Conn. Name	Harness Purpose	Harness Conn. Type	Harness Connector - Part Number - Mount Type, Entry - Backshell P/N	Mating Connector - Part Number - Mount Type, Entry - Backshell P/N - Location or (Ref. Des.)
EPH-P1	Instrument & op-heater power	MDM 9P	TBD (APL) Harness TBD (APL)	MWDM2L-9SCBRR2-.110-429 TH, Right angle Rear panel 0.047" thick On LVPS Board (EPH-J1)
EPH-P2	Command & data I/F	MDM 15P	TBD (APL) Harness TBD (APL)	MWDM2L-15SCBRR2-.110-429 TH, Right angle Rear panel 0.047" thick On DPU Board (EPH-J2)
EPH-P3	S/C RTDs	MDM 15P	TBD (APL) Harness TBD (APL)	MWDM2L-15SSB-429 Harness, Bracket 0.060" thick 507T088XM15H08S On E-Box (EPH-J3)
EPH-P4	Survival heater Power	MDM 9P	TBD (APL) Harness TBD (APL)	MWDM2L-9SSB-429 Harness, Bracket 0.060" thick 507T088XM09H08S On E-Box (EPH-J4)

5.2 *Thermal Harness Connector Types*

Harness Conn. Name	Harness Purpose	Harness Conn. Type	Harness Connector - Part Number - Mount Type, Entry - Backshell P/N	Mating Connector - Part Number - Mount Type, Entry - Backshell P/N - Location or (Ref. Des.)
EPH-J3	S/C RTDs	MDM 15S	MWDM2L-15SSB-429 Harness, Bracket 0.060" thick 507T088XM15H08S	TBD (APL) Harness TBD (APL)
EPH-J4	Survival heater Power	MDM 9S	MWDM2L-9SSB-429 Harness, Bracket 0.060" thick 507T088XM09H08S	TBD (APL) Harness TBD (APL)
EPH-P5	Instrument op-heater & thermistor control	MDM 21S	MWDM2L-21SSB-429 Harness, RT 507S088XM21H12S	MWDM2L-21PCBRR2-.110-429 TH, Right angle Rear panel 0.047" thick On DPU Board (EPH-J5)

5.3 *Electronics Connector Types*

Harness Conn. Name	Harness Purpose	Harness Conn. Type	Harness Connector - Part Number - Mount Type, Entry - Backshell P/N	Mating Connector - Part Number - Mount Type, Entry, Location or (Ref. Des.)
LVPS-P1	LVPS outputs & op-heater power	Nano 51S	891-007-51SA2-BST1J-429 TH on flex strip, Straight, On DPU Board	891-008-51PA2-BRT1T-429 TH, Right angle On LVPS Board (LVPS-J1)
DPU-P1	Bias Supply power & control signals	Nano 31S	891-009-31SA2-BRT1J-429 TH on flex strip, Right angle, On Bias Supply Board	891-008-31PA2-BRT1T-429 TH, Right angle On DPU Board (DPU-J1)
LET1-P1	Power, data & commands for LET1	Nano 25P	891-006-25PA2-BST1J-429 TH on flex strip, Straight	891-009-25SA2-BRT1T-429 TH, Right angle, On LET1 board (LET1-J1)
LET2-P1	Power, data & commands for LET2	Nano 25P	891-006-25PA2-BST1J-429 TH on flex strip, Straight	891-009-25SA2-BRT1T-429 TH, Right angle, (LET2-J1)
HET-P1	Power, data & commands for HET	Nano 25P	891-006-25PA2-BST1J-429 TH on flex strip, Straight	891-009-25SA2-BRT1T-429 TH, Right angle, (HET-J1)
LET1-P2	Bias Supply outputs for LET1	MicroStrip 14P	171-007-14P-.110-PB-429 TH on flex strip, Straight	171-154-429 SM, Right angle, (LET1-J2)
LET2-P2	Bias Supply outputs for LET2	MicroStrip 14P	171-007-14P-.110-PB-429 TH on flex strip, Straight	171-154-429 SM, Right angle, (LET2-J2)
HET-P2	Bias Supply outputs for HET	MicroStrip 14P	171-007-14P-.110-PB-429 TH on flex strip, Straight	171-154-429 SM, Right angle, (HET-J2)
LET1-P3	Signals from LET1 detectors	Nano 51S	891-007-51SA2-BST1J-429 TH on flex strip, Straight	891-008-51PA2-BRT1T-429 TH, Right angle, (LET1-J3)
LET2-P3	Signals from LET2 detectors	Nano 51S	891-007-51SA2-BST1J-429 TH on flex strip, Straight	891-008-51PA2-BRT1T-429 TH, Right angle, (LET2-J3)
HET-P3	Signals from HET detectors	Nano 51S	891-007-51SA2-BST1J-429 TH on flex strip, Straight	891-008-51PA2-BRT1T-429 TH, Right angle, (HET-J3)
LET1-P4	Bias for LET1 detectors	MicroStrip 10S	171-155-429 TH on flex strip, Straight	171-008-16P-PBMH-429 SM, Right angle, (LET1-J4)
LET2-P4	Bias for LET2 detectors	MicroStrip 10S	171-155-429 TH on flex strip, Straight	171-008-16P-PBMH-429 SM, Right angle, (LET2-J4)
HET-P4	Bias for HET detectors	MicroStrip 10S	171-155-429 TH on flex strip, Straight	171-008-16P-PBMH-429 SM, Right angle, (HET-J4)

Notes:
1. P/N 171-154-429 derived from Glenair standard catalog P/N 171-008-20S-PBMH-429
2. P/N 171-155-429 derived from Glenair standard catalog P/N 171-007-10S-.110-PB-429
These connectors have been modified so guide pins can be tied to GND.

5.3 *Telescope Connector Types*

Harness Conn. Name	Harness Purpose	Harness Conn. Type	Harness Connector - Part Number - Mount Type, Entry	Mating Connector - Part Number - Mount Type, Entry - Location or (Ref. Des.)
L0A-P5 L1A-P5 L1B-P5 L0B-P5 L0C-P5 L1C-P5	Detector signals and bias	MicroStrip 12P	171-131-429 TH on flex strip, Straight, On Flex Cable going between telescope and telescope board (this connector is mounted on the cable's telescope end)	171-130-429 DB on flex strip, Straight, On Detector Mount
L2A-P5 L3A-P5 L4A-P5 L4B-P5 L3B-P5 L2B-P5 L2C-P5 L3C-P5 L4C-P5 L5C-P5 L6C-P5 H1A-P5 H2A-P5 H3A1-P5 H3A2-P5 H4A1-P5 H4A2-P5 H5A1-P5 H5A2-P5 H5B2-P5 H5B1-P5 H4B2-P5 H4B1-P5 H3B2-P5 H3B1-P5 H2B-P5 H1B-P5	Detector signals and bias	MicroStrip 14P	171-131x-429 TH on flex strip, Straight, On Flex Cable going between telescope and telescope board (this connector is mounted on the cable's telescope end)	171-130x-429 DB on flex strip, Straight, On Detector Mount

Notes:
1. P/N 171-130-429 derived from standard catalog P/N 171-007-18S-.125-PBMH-429
2. P/N 171-131-429 derived from standard catalog P/N 171-002-18P-6C4-.125-PBMH-429
3. P/N 171-130x-429 derived from standard catalog P/N 171-007-20S-.125-PBMH-429
4. P/N 171-131x-429 derived from standard catalog P/N 171-002-20P-6C4-.125-PBMH-429

These connectors have been modified so guide pins can be tied to GND or the nearest signal in order to prevent floating, and cavities on each side of the HV contact have been filled with epoxy.

6. Connector Pinouts

6.1 *S/C Interface Connector Pinouts*

6.1.1 EPH-P1 Instrument & Operational Heater Power
Harness responsibility: JHU/APL

Pin	Signal Name	Destination	Wire Type/Grouping
1	+28V INST RTN	S/C PDU	#24 TQS, twist group 1
2	+28V INST RTN	S/C PDU	#24 TQS, twist group 1
3	CHASSIS	To backshell	#24 SC
4	+28V OP HTR RTN	S/C PDU	#24 TQ, twist group 2
5	+28V OP HTR RTN	S/C PDU	#24 TQ, twist group 2
6	+28V INST	S/C PDU	#24 TQS, twist group 1
7	+28V INST	S/C PDU	#24 TQS, twist group 1
8	+28V OP HTR	S/C PDU	#24 TQ, twist group 2
9	+28V OP HTR	S/C PDU	#24 TQ, twist group 2

Note: This is a wire harness. Over-shield and inner shields shall be made of EMI/Kapton tape and tied to each other and the backshells on both ends.

6.1.2 EPH-P2 Command & Data Signals
Harness responsibility: JHU/APL

Pin	Signal Name	Destination	Wire Type/Grouping
1	CHASSIS GND	To backshell	#24 SC
2	DPU TLM A*+	S/C C&DH side A	#24 TPS, twist group 1
3	DPU TLM A*-	S/C C&DH side A	#24 TPS, twist group 1
4	GSE CMD*+		GSE cable, I&T only
5	GSE CMD*-		GSE cable, I&T only
6	DPU CMD A*+	S/C C&DH side A	#24 TPS, twist group 2
7	DPU CMD A*-	S/C C&DH side A	#24 TPS, twist group 2
8	Spare		
9	GSE CMD ECHO*+		GSE cable, I&T only
10	DPU TLM B*+	S/C C&DH side B	#24 TPS, twist group 3
11	DPU TLM B*-	S/C C&DH side B	#24 TPS, twist group 3
12	GSE CMD ECHO*-		GSE cable, I&T only
13	DPU CMD B*+	S/C C&DH side B	#24 TPS, twist group 4
14	DPU CMD B*-	S/C C&DH side B	#24 TPS, twist group 4
15	CHASSIS GND	To backshell	#24 SC

Note: This is a wire harness. Over-shield and inner shields shall be made of EMI/Kapton tape and tied to each other and the backshells on both ends.

6.1.3 EPH-P3 S/C RTDs
Harness responsibility: JHU/APL

Pin	Signal Name	Destination	Wire Type/Grouping
1	LET1 S/C TEMP	S/C RTD Readout	#24 TPS, twist group 1
2	LET1 S/C TEMP RTN	S/C RTD Readout	#24 TPS, twist group 1
3	Spare		
4	LET2 S/C TEMP	S/C RTD Readout	#24 TPS, twist group 2
5	LET2 S/C TEMP RTN	S/C RTD Readout	#24 TPS, twist group 2
6	Spare		
7	HET S/C TEMP	S/C RTD Readout	#24 TPS, twist group 3
8	HET S/C TEMP RTN	S/C RTD Readout	#24 TPS, twist group 3
9	Spare		
10	E-BOX S/C TEMP 1	S/C RTD Readout	#24 TPS, twist group 4
11	E-BOX S/C TEMP 1 RTN	S/C RTD Readout	#24 TPS, twist group 4
12	Spare		
13	E-BOX S/C TEMP 2	S/C RTD Readout	#24 TP, twist group 5
14	E-BOX S/C TEMP 2 RTN	S/C RTD Readout	#24 TP, twist group 5
15	Spare		

Note: This is a wire harness. Over-shield and inner shields shall be made of EMI/Kapton tape and tied to each other and the backshells on both ends.

6.1.4 EPH-P4 Survival Heater Power
Harness responsibility: JHU/APL

Pin	Signal Name	Destination	Wire Type/Grouping
1	+28V SURV HTR RTN	S/C PDU	#24 TQ, twist group 1
2	+28V SURV HTR RTN	S/C PDU	#24 TQ, twist group 1
3	CHASSIS	To backshell	#24 SC
4	Spare		
5	Spare		
6	+28V SURV HTR	S/C PDU	#24 TQ, twist group 1
7	+28V SURV HTR	S/C PDU	#24 TQ, twist group 1
8	Spare		
9	Spare		

Note: This is a wire harness. Over-shield and inner shields shall be made of EMI/Kapton tape and tied to each other and the backshells on both ends.

6.2 *Thermal Harness Connector Pinouts*

6.2.1 EPH-J3 S/C RTDs
Harness responsibility: Caltech

Pin	Signal Name	Destination	Wire Type/Grouping
1	LET1 S/C TEMP	S/C RTD lead 1	#26Æ TPS, twist group 1
2	LET1 S/C TEMP RTN	S/C RTD lead 2	#26Æ TPS, twist group 1
3	Spare		
4	LET2 S/C TEMP	S/C RTD lead 1	#26Æ TPS, twist group 2
5	LET2 S/C TEMP RTN	S/C RTD lead 2	#26Æ TPS, twist group 2
6	Spare		
7	HET S/C TEMP	S/C RTD lead 1	#26Æ TPS, twist group 3
8	HET S/C TEMP RTN	S/C RTD lead 2	#26Æ TPS, twist group 3
9	Spare		
10	E-BOX S/C TEMP 1	S/C RTD lead 1	#26Æ TPS, twist group 4
11	E-BOX S/C TEMP 1 RTN	S/C RTD lead 2	#26Æ TPS, twist group 4
12	Spare		
13	E-BOX S/C TEMP 2	S/C RTD lead 1	#26Æ TP, twist group 5
14	E-BOX S/C TEMP 2 RTN	S/C RTD lead 2	#26Æ TP, twist group 5
15	Spare		

Note: This is a wire harness. Over-shield is made of EMI/Kapton tape. The over-shield and inner shields are tied to the backshell only on EPH-J3 end.
Æ This wire is a pigtail coming from S/C RTD.

6.2.2 EPH-J4 Survival Heater Power
Harness responsibility: Caltech

Pin	Signal Name	Destination	Wire Type/Grouping
1	+28V SURV HTR RTN	Surv heater lead 2	#26π TQ, twist group 1
2	+28V SURV HTR RTN	Surv heater lead 2	#26π TQ, twist group 1
3	CHASSIS	To backshell	#24 Single conductor
4	Spare		
5	Spare		
6	+28V SURV HTR	Thermostat lead 1	#26π TQ, twist group 1
7	+28V SURV HTR	Thermostat lead 1	#26π TQ, twist group 1
8	Spare		
9	Spare		

Note: This is a wire harness. Over-shield is made of EMI/Kapton tape. The over-shield and inner shields are tied to the backshell only on EPH-J4 end.
π This wire is a pigtail from thermostat to pins 6&7; Kapton patch heater (survival) to pins 1&2.

6.2.3 EPH-P5 Instrument Op-Heater & Thermistor Control
Harness responsibility: Caltech

Pin	Signal Name	Destination	Wire Type/Grouping
1	HET EXT TEMP1+	Thermistor lead 1	#28Δ TPS, twist group 1
2	HET EXT TEMP2+	Thermistor lead 1	#28Δ TPS, twist group 2
3	LET1 EXT TEMP1+	Thermistor lead 1	#28Δ TPS, twist group 3
4	LET1 EXT TEMP2+	Thermistor lead 1	#28Δ TPS, twist group 4
5	LET2 EXT TEMP1+	Thermistor lead 1	#28Δ TPS, twist group 5
6	LET2 EXT TEMP2+	Thermistor lead 1	#28Δ TPS, twist group 6
7	Spare		
8	Spare		
9	+28V HET OP HTR	Oper. heater lead 1	#26£ TPS, twist group 7
10	+28V LET1 OP HTR	Oper. heater lead 1	#26£ TPS, twist group 8
11	+28V LET2 OP HTR	Oper. heater lead 1	#26£ TP, twist group 9
12	HET EXT TEMP1-	Thermistor lead 2	#28Δ TPS, twist group 1
13	HET EXT TEMP2-	Thermistor lead 2	#28Δ TPS, twist group 2
14	LET1 EXT TEMP1-	Thermistor lead 2	#28Δ TPS, twist group 3
15	LET1 EXT TEMP2-	Thermistor lead 2	#28Δ TPS, twist group 4
16	LET2 EXT TEMP1-	Thermistor lead 2	#28Δ TPS, twist group 5
17	LET2 EXT TEMP2-	Thermistor lead 2	#28Δ TPS, twist group 6
18	Spare		
19	+28V HET OP HTR RTN	Oper. heater lead 2	#26£ TPS, twist group 7
20	+28V LET1 OP HTR RTN	Oper. heater lead 2	#26£ TPS, twist group 8
21	+28V LET2 OP HTR RTN	Oper. heater lead 2	#26£ TP, twist group 9

Note: This is a wire harness. Over-shield is made of EMI/Kapton tape. The over-shield and inner shields are tied to the backshell only on EPH-P5 end.
Δ This wire is a pigtail coming from instrument thermistor.
£ This wire is a pigtail coming from Kapton patch heater (operational).

6.3 *Electronics Connector Pinouts*

6.3.1 LVPS-P1 LVPS Outputs & Op-Heater Power

Pin	Signal Name	Destination	Wire Type/Grouping
1	+6A	Main rigid part of	Trace on rigid-flex cable
2	+6A	DPU Board	" " " "
3	+6A	" "	" " " "
4	+6A	" "	" " " "
5	+6A	" "	" " " "
6	+12A	" "	" " " "
7	+12A	" "	" " " "
8	+12A	" "	" " " "
9	+12A PWR RTN	" "	" " " "
10	LVPS TEMP+	" "	" " " "
11	LVPS TEMP+	" "	" " " "
12	+1.5D	" "	" " " "
13	+1.5D	" "	" " " "
14	+1.5D	" "	" " " "
15	DIG PWR RTN	" "	GND plane on rgd-flex cbl
16	DIG PWR RTN	" "	" " " "
17	DIG PWR RTN	" "	" " " "
18	DIG PWR RTN	" "	" " " "
19	PRIM I MON+	" "	Trace on rigid-flex cable
20	PRIM I MON+	" "	" " " "
21	+28V OP HTR	" "	" " " "
22	+28V OP HTR	" "	" " " "
23	+28V OP HTR	" "	" " " "
24	+28V OP HTR	" "	" " " "
25	Spare		
26	400 KHZ CLK	" "	" " " "
27	ANA PWR RTN	" "	GND plane on rgd-flex cbl
28	ANA PWR RTN	" "	" " " "
29	ANA PWR RTN	" "	" " " "
30	ANA PWR RTN	" "	" " " "
31	ANA PWR RTN	" "	" " " "
32	-6A	" "	Trace on rigid-flex cable
33	-6A	" "	" " " "
34	-6A	" "	" " " "
35	+12A PWR RTN	" "	" " " "
36	LVPS TEMP-	" "	" " " "
37	LVPS TEMP-	" "	" " " "
38	+1.8D	" "	" " " "
39	+1.8D	" "	" " " "
40	+1.8D	" "	" " " "
41	+3.3D	" "	" " " "
42	+3.3D	" "	" " " "

43	+3.3D	" "	" " " "
44	PRIM I MON-	" "	" " " "
45	PRIM I MON-	" "	" " " "
46	+28V OP HTR RTN	" "	" " " "
47	+28V OP HTR RTN	" "	" " " "
48	+28V OP HTR RTN	" "	" " " "
49	+28V OP HTR RTN	" "	" " " "
50	Spare		
51	400 KHZ CLK	" "	" " " "

Note: This is a rigid-flex cable. Digital power/signal traces shall run separately from analog ones.

6.3.2 DPU-P1 Bias Supply Power & Control Signals

Pin	Signal Name	Destination	Wire Type/Grouping
1	+12A	Main rigid part of	Trace on rigid-flex cable
2	+12A	Bias Supply Board	" " " "
3	+5A	" " "	" " " "
4	+5A	" " "	" " " "
5	-6A	" " "	" " " "
6	-6A	" " "	" " " "
7	ANA PWR RTN	" " "	GND plane on rgd-flex cbl
8	ANA PWR RTN	" " "	" " " "
9	LET1 A CTRL	" " "	Trace on rigid-flex cable
10	LET1 A CTRL	" " "	" " " "
11	LET1 B CTRL	" " "	" " " "
12	LET1 B CTRL	" " "	" " " "
13	BIAS TEMP +	" " "	" " " "
14	BIAS TEMP +	" " "	" " " "
15	BIAS TEMP -	" " "	" " " "
16	BIAS TEMP -	" " "	" " " "
17	+12A PWR RTN	" " "	GND plane on rgd-flex cbl
18	+12A PWR RTN	" " "	" " " "
19	LET2 CTRL	" " "	Trace on rigid-flex cable
20	LET2 CTRL	" " "	" " " "
21	HET A CTRL	" " "	" " " "
22	HET A CTRL	" " "	" " " "
23	HET B CTRL	" " "	" " " "
24	HET B CTRL	" " "	" " " "
25	Spare		
26	Spare		
27	Spare		
28	DIG PWR RTN	" " "	GND plane on rgd-flex cbl
29	DIG PWR RTN	" " "	" " " "
30	50 KHZ CLK	" " "	" " " "
31	50 KHZ CLK	" " "	" " " "

Note: This is a rigid-flex cable. Digital power/signal traces shall run separately from analog ones.

6.3.3 LET1-P1 Power, Data & Commands for LET1

Pin	Signal Name	Destination	Wire Type/Grouping
1	LET1 +1.5D	Main rigid part of	Trace on rigid-flex cable
2	LET1 +1.5D	DPU Board	" " " "
3	LET1 +1.8D	" "	" " " "
4	LET1 +1.8D	" "	" " " "
5	LET1 +3.3D	" "	" " " "
6	LET1 +3.3D	" "	" " " "
7	LET1 DIG RTN	" "	GND plane on rgd-flex cbl
8	LET1 DIG RTN	" "	" " " "
9	LET1 ANA RTN	" "	" " " "
10	LET1 ANA RTN	" "	" " " "
11	LET1 -6A	" "	Trace on rigid-flex cable
12	LET1 -6A	" "	" " " "
13	LET1 ANA RTN	" "	GND plane on rgd-flex cbl
14	LET1 CMD*+	" "	Trace on rigid-flex cable
15	LET1 CMD*+	" "	" " " "
16	LET1 CMD ECHO*+	" "	" " " "
17	LET1 CMD ECHO*+	" "	" " " "
18	LET1 DATA*+	" "	" " " "
19	LET1 DATA*+	" "	" " " "
20	LET1 DIG RTN	" "	GND plane on rgd-flex cbl
21	LET1 DIG RTN	" "	" " " "
22	LET1 +12A	" "	Trace on rigid-flex cable
23	LET1 +12A	" "	" " " "
24	LET1 +6A	" "	" " " "
25	LET1 +6A	" "	" " " "

Note: This is a rigid-flex cable. Digital power/signal traces shall run separately from analog ones.

6.3.4 LET1-P2 Bias Supply Outputs for LET1

Pin	Signal Name	Destination	Wire Type/Grouping
1	Cavity for guide pin	Main rigid part of	
2	LET1 BIAS RTN	Bias Supply Board	GND plane on rgd-flex cbl
3	LET1 25V	" " "	Trace on rigid-flex cable
4	LET1 L2A HV	" " "	" " " "
5	LET1 L34A HV	" " "	" " " "
6	LET1 L34A HV	" " "	" " " "
7	LET1 L2A HV	" " "	" " " "
8	LET1 L2B HV	" " "	" " " "
9	LET1 L34B HV	" " "	" " " "
10	LET1 L34B HV	" " "	" " " "
11	LET1 L2B HV	" " "	" " " "
12	LET1 25V	" " "	" " " "
13	LET1 BIAS RTN	" " "	GND plane on rgd-flex cbl
14	Cavity for guide pin		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes.

6.3.5 LET1-P3 Signals from LET1 Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Pinout TBD (Caltech)	Lxx-P5 pin TBD	Trace on rigid-flex cable
2	Pinout TBD (Caltech)	" " "	" " " "
3	Pinout TBD (Caltech)	" " "	" " " "
4	Pinout TBD (Caltech)	" " "	" " " "
5	Pinout TBD (Caltech)	" " "	" " " "
6	Pinout TBD (Caltech)	" " "	" " " "
7	Pinout TBD (Caltech)	" " "	" " " "
8	Pinout TBD (Caltech)	" " "	" " " "
9	Pinout TBD (Caltech)	" " "	" " " "
10	Pinout TBD (Caltech)	" " "	" " " "
11	Pinout TBD (Caltech)	" " "	" " " "
12	Pinout TBD (Caltech)	" " "	" " " "
13	Pinout TBD (Caltech)	" " "	" " " "
14	Pinout TBD (Caltech)	" " "	" " " "
15	Pinout TBD (Caltech)	" " "	" " " "
16	Pinout TBD (Caltech)	" " "	" " " "
17	Pinout TBD (Caltech)	" " "	" " " "
18	Pinout TBD (Caltech)	" " "	" " " "
19	Pinout TBD (Caltech)	" " "	" " " "
20	Pinout TBD (Caltech)	" " "	" " " "
21	Pinout TBD (Caltech)	" " "	" " " "
22	Pinout TBD (Caltech)	" " "	" " " "
23	Pinout TBD (Caltech)	" " "	" " " "
24	Pinout TBD (Caltech)	" " "	" " " "

25	Pinout TBD (Caltech)	" " "	" " " "
26	Pinout TBD (Caltech)	" " "	" " " "
27	Pinout TBD (Caltech)	" " "	" " " "
28	Pinout TBD (Caltech)	" " "	" " " "
29	Pinout TBD (Caltech)	" " "	" " " "
30	Pinout TBD (Caltech)	" " "	" " " "
31	Pinout TBD (Caltech)	" " "	" " " "
32	Pinout TBD (Caltech)	" " "	" " " "
33	Pinout TBD (Caltech)	" " "	" " " "
34	Pinout TBD (Caltech)	" " "	" " " "
35	Pinout TBD (Caltech)	" " "	" " " "
36	Pinout TBD (Caltech)	" " "	" " " "
37	Pinout TBD (Caltech)	" " "	" " " "
38	Pinout TBD (Caltech)	" " "	" " " "
39	Pinout TBD (Caltech)	" " "	" " " "
40	Pinout TBD (Caltech)	" " "	" " " "
41	Pinout TBD (Caltech)	" " "	" " " "
42	Pinout TBD (Caltech)	" " "	" " " "
43	Pinout TBD (Caltech)	" " "	" " " "
44	Pinout TBD (Caltech)	" " "	" " " "
45	Pinout TBD (Caltech)	" " "	" " " "
46	Pinout TBD (Caltech)	" " "	" " " "
47	Pinout TBD (Caltech)	" " "	" " " "
48	Pinout TBD (Caltech)	" " "	" " " "
49	Pinout TBD (Caltech)	" " "	" " " "
50	Pinout TBD (Caltech)	" " "	" " " "
51	Pinout TBD (Caltech)	" " "	" " " "

Note: This is a rigid-flex cable. Analog signal traces shall run sandwiched between GND planes.

6.3.6 LET1-P4 Bias for LET1 Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Guide pin tied to L0A BIAS		
2	L0A BIAS	L0A-P5 pin 4	Trace on rigid-flex cable
3	L1A BIAS	L1A-P5 pin 4	" " " "
4	L2A BIAS	L2A-P5 pin 5	" " " "
5	L34A BIAS	L3A-P5 pin 5, L4A-P5 pin 5	" " " "
6	L34B BIAS	L4B-P5 pin 5, L3B-P5 pin 5	" " " "
7	L2B BIAS	L2B-P5 pin 5	" " " "
8	L1B BIAS	L1B-P5 pin 4	" " " "
9	L0B BIAS	L0B-P5 pin 4	" " " "
10	Guide pin tied to L0B BIAS		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes that originate from the neighboring LET1-P3 connector located on the same rigid-flex cable.

6.3.7 LET2-P1 Power, Data & Commands for LET2

Pin	Signal Name	Destination	Wire Type/Grouping
1	LET2 +1.5D	Main rigid part of	Trace on rigid-flex cable
2	LET2 +1.5D	DPU Board	" " " "
3	LET2 +1.8D	" "	" " " "
4	LET2 +1.8D	" "	" " " "
5	LET2 +3.3D	" "	" " " "
6	LET2 +3.3D	" "	" " " "
7	LET2 DIG RTN	" "	GND plane on rgd-flex cbl
8	LET2 DIG RTN	" "	" " " "
9	LET2 ANA RTN	" "	" " " "
10	LET2 ANA RTN	" "	" " " "
11	LET2 -6A	" "	Trace on rigid-flex cable
12	LET2 -6A	" "	" " " "
13	LET2 ANA RTN	" "	GND plane on rgd-flex cbl
14	LET2 CMD*+	" "	Trace on rigid-flex cable
15	LET2 CMD*+	" "	" " " "
16	LET2 CMD ECHO*+	" "	" " " "
17	LET2 CMD ECHO*+	" "	" " " "
18	LET2 DATA*+	" "	" " " "
19	LET2 DATA*+	" "	" " " "
20	LET2 DIG RTN	" "	GND plane on rgd-flex cbl
21	LET2 DIG RTN	" "	" " " "
22	LET2 +12A	" "	Trace on rigid-flex cable
23	LET2 +12A	" "	" " " "
24	LET2 +6A	" "	" " " "
25	LET2 +6A	" "	" " " "

Note: This is a rigid-flex cable. Digital power/signal traces shall run separately from analog ones.

6.3.8 LET2-P2 Bias Supply Outputs for LET2

Pin	Signal Name	Destination	Wire Type/Grouping
1	Cavity for guide pin	Main rigid part of	
2	LET2 BIAS RTN	Bias Supply Board	GND plane on rgd-flex cbl
3	LET2 25V	" " "	Trace on rigid-flex cable
4	LET2 L2 HV	" " "	" " " "
5	LET2 L3-6 HV	" " "	" " " "
6	Spare		
7	Spare		
8	LET2 L2 HV	" " "	" " " "
9	LET2 L3-6 HV	" " "	" " " "
10	Spare		
11	Spare		
12	LET2 25V	" " "	" " " "
13	LET2 BIAS RTN	" " "	GND plane on rgd-flex cbl
14	Cavity for guide pin		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes.

6.3.9 LET2-P3 Signals from LET2 Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Pinout TBD (Caltech)	LxC-P5 pin TBD	Trace on rigid-flex cable
2	Pinout TBD (Caltech)	" " "	" " " "
3	Pinout TBD (Caltech)	" " "	" " " "
4	Pinout TBD (Caltech)	" " "	" " " "
5	Pinout TBD (Caltech)	" " "	" " " "
6	Pinout TBD (Caltech)	" " "	" " " "
7	Pinout TBD (Caltech)	" " "	" " " "
8	Pinout TBD (Caltech)	" " "	" " " "
9	Pinout TBD (Caltech)	" " "	" " " "
10	Pinout TBD (Caltech)	" " "	" " " "
11	Pinout TBD (Caltech)	" " "	" " " "
12	Pinout TBD (Caltech)	" " "	" " " "
13	Pinout TBD (Caltech)	" " "	" " " "
14	Pinout TBD (Caltech)	" " "	" " " "
15	Pinout TBD (Caltech)	" " "	" " " "
16	Pinout TBD (Caltech)	" " "	" " " "
17	Pinout TBD (Caltech)	" " "	" " " "
18	Pinout TBD (Caltech)	" " "	" " " "
19	Pinout TBD (Caltech)	" " "	" " " "
20	Pinout TBD (Caltech)	" " "	" " " "
21	Pinout TBD (Caltech)	" " "	" " " "
22	Pinout TBD (Caltech)	" " "	" " " "
23	Pinout TBD (Caltech)	" " "	" " " "
24	Pinout TBD (Caltech)	" " "	" " " "

25	Pinout TBD (Caltech)	" " "	" " " "
26	Pinout TBD (Caltech)	" " "	" " " "
27	Pinout TBD (Caltech)	" " "	" " " "
28	Pinout TBD (Caltech)	" " "	" " " "
29	Pinout TBD (Caltech)	" " "	" " " "
30	Pinout TBD (Caltech)	" " "	" " " "
31	Pinout TBD (Caltech)	" " "	" " " "
32	Pinout TBD (Caltech)	" " "	" " " "
33	Pinout TBD (Caltech)	" " "	" " " "
34	Pinout TBD (Caltech)	" " "	" " " "
35	Pinout TBD (Caltech)	" " "	" " " "
36	Pinout TBD (Caltech)	" " "	" " " "
37	Pinout TBD (Caltech)	" " "	" " " "
38	Pinout TBD (Caltech)	" " "	" " " "
39	Pinout TBD (Caltech)	" " "	" " " "
40	Pinout TBD (Caltech)	" " "	" " " "
41	Pinout TBD (Caltech)	" " "	" " " "
42	Pinout TBD (Caltech)	" " "	" " " "
43	Pinout TBD (Caltech)	" " "	" " " "
44	Pinout TBD (Caltech)	" " "	" " " "
45	Pinout TBD (Caltech)	" " "	" " " "
46	Pinout TBD (Caltech)	" " "	" " " "
47	Pinout TBD (Caltech)	" " "	" " " "
48	Pinout TBD (Caltech)	" " "	" " " "
49	Pinout TBD (Caltech)	" " "	" " " "
50	Pinout TBD (Caltech)	" " "	" " " "
51	Pinout TBD (Caltech)	" " "	" " " "

Note: This is a rigid-flex cable. Analog signal traces shall run sandwiched between GND planes.

6.3.10 LET2-P4 Bias for LET2 Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Guide pin tied to L0C BIAS		
2	L0C BIAS	L0C-P5 pin 4	Trace on rigid-flex cable
3	L1C BIAS	L1C-P5 pin 4	" " " "
4	L2C BIAS	L2C-P5 pin 5	" " " "
5	L36C BIAS	L3C-P5 pin 5, L4C-P5 pin 5, L5C-P5 pin 5, L6C-P5 pin 5	" " " "
6	L36C BIAS	" " "	" " " "
7	L2C BIAS	L2C-P5 pin 5	" " " "
8	L1C BIAS	L1C-P5 pin 4	" " " "
9	L0C BIAS	L0C-P5 pin 4	" " " "
10	Guide pin tied to L0C BIAS		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes that originate from the neighboring LET2-P3 connector located on the same rigid-flex cable.

6.3.11 HET-P1 Power, Data & Commands for HET

Pin	Signal Name	Destination	Wire Type/Grouping
1	HET +1.5D	Main rigid part of	Trace on rigid-flex cable
2	HET +1.5D	DPU Board	" " " "
3	HET +1.8D	" "	" " " "
4	HET +1.8D	" "	" " " "
5	HET +3.3D	" "	" " " "
6	HET +3.3D	" "	" " " "
7	HET DIG RTN	" "	GND plane on rgd-flex cbl
8	HET DIG RTN	" "	" " " "
9	HET ANA RTN	" "	" " " "
10	HET ANA RTN	" "	" " " "
11	HET -6A	" "	Trace on rigid-flex cable
12	HET -6A	" "	" " " "
13	HET ANA RTN	" "	GND plane on rgd-flex cbl
14	HET CMD*+	" "	Trace on rigid-flex cable
15	HET CMD*+	" "	" " " "
16	HET CMD ECHO*+	" "	" " " "
17	HET CMD ECHO*+	" "	" " " "
18	HET DATA*+	" "	" " " "
19	HET DATA*+	" "	" " " "
20	HET DIG RTN	" "	GND plane on rgd-flex cbl
21	HET DIG RTN	" "	" " " "
22	HET +12A	" "	Trace on rigid-flex cable
23	HET +12A	" "	" " " "
24	HET +6A	" "	" " " "
25	HET +6A	" "	" " " "

Note: This is a rigid-flex cable. Digital power/signal traces shall run separately from analog ones.

6.3.12 HET-P2 Bias Supply Outputs for HET

Pin	Signal Name	Destination	Wire Type/Grouping
1	Cavity for guide pin	Main rigid part of	
2	HET BIAS RTN	Bias Supply Board	GND plane on rgd-flex cbl
3	Spare		
4	HET H1A HV	" " "	Trace on rigid-flex cable
5	HET H25A HV	" " "	" " " "
6	HET H25A HV	" " "	" " " "
7	HET H1A HV	" " "	" " " "
8	HET H1B HV	" " "	" " " "
9	HET H25B HV	" " "	" " " "
10	HET H25B HV	" " "	" " " "
11	HET H1B HV	" " "	" " " "
12	Spare		
13	HET BIAS RTN	" " "	GND plane on rgd-flex cbl
14	Cavity for guide pin		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes.

6.3.13 HET-P3 Signals from HET Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Pinout TBD (Caltech)	Hxxx-P5 pin TBD	Trace on rigid-flex cable
2	Pinout TBD (Caltech)	" " "	" " " "
3	Pinout TBD (Caltech)	" " "	" " " "
4	Pinout TBD (Caltech)	" " "	" " " "
5	Pinout TBD (Caltech)	" " "	" " " "
6	Pinout TBD (Caltech)	" " "	" " " "
7	Pinout TBD (Caltech)	" " "	" " " "
8	Pinout TBD (Caltech)	" " "	" " " "
9	Pinout TBD (Caltech)	" " "	" " " "
10	Pinout TBD (Caltech)	" " "	" " " "
11	Pinout TBD (Caltech)	" " "	" " " "
12	Pinout TBD (Caltech)	" " "	" " " "
13	Pinout TBD (Caltech)	" " "	" " " "
14	Pinout TBD (Caltech)	" " "	" " " "
15	Pinout TBD (Caltech)	" " "	" " " "
16	Pinout TBD (Caltech)	" " "	" " " "
17	Pinout TBD (Caltech)	" " "	" " " "
18	Pinout TBD (Caltech)	" " "	" " " "
19	Pinout TBD (Caltech)	" " "	" " " "
20	Pinout TBD (Caltech)	" " "	" " " "
21	Pinout TBD (Caltech)	" " "	" " " "
22	Pinout TBD (Caltech)	" " "	" " " "
23	Pinout TBD (Caltech)	" " "	" " " "
24	Pinout TBD (Caltech)	" " "	" " " "

25	Pinout TBD (Caltech)	“	“	“	“	“	“	“
26	Pinout TBD (Caltech)	“	“	“	“	“	“	“
27	Pinout TBD (Caltech)	“	“	“	“	“	“	“
28	Pinout TBD (Caltech)	“	“	“	“	“	“	“
29	Pinout TBD (Caltech)	“	“	“	“	“	“	“
30	Pinout TBD (Caltech)	“	“	“	“	“	“	“
31	Pinout TBD (Caltech)	“	“	“	“	“	“	“
32	Pinout TBD (Caltech)	“	“	“	“	“	“	“
33	Pinout TBD (Caltech)	“	“	“	“	“	“	“
34	Pinout TBD (Caltech)	“	“	“	“	“	“	“
35	Pinout TBD (Caltech)	“	“	“	“	“	“	“
36	Pinout TBD (Caltech)	“	“	“	“	“	“	“
37	Pinout TBD (Caltech)	“	“	“	“	“	“	“
38	Pinout TBD (Caltech)	“	“	“	“	“	“	“
39	Pinout TBD (Caltech)	“	“	“	“	“	“	“
40	Pinout TBD (Caltech)	“	“	“	“	“	“	“
41	Pinout TBD (Caltech)	“	“	“	“	“	“	“
42	Pinout TBD (Caltech)	“	“	“	“	“	“	“
43	Pinout TBD (Caltech)	“	“	“	“	“	“	“
44	Pinout TBD (Caltech)	“	“	“	“	“	“	“
45	Pinout TBD (Caltech)	“	“	“	“	“	“	“
46	Pinout TBD (Caltech)	“	“	“	“	“	“	“
47	Pinout TBD (Caltech)	“	“	“	“	“	“	“
48	Pinout TBD (Caltech)	“	“	“	“	“	“	“
49	Pinout TBD (Caltech)	“	“	“	“	“	“	“
50	Pinout TBD (Caltech)	“	“	“	“	“	“	“
51	Pinout TBD (Caltech)	“	“	“	“	“	“	“

Note: This is a rigid-flex cable. Analog signal traces shall run sandwiched between GND planes.

6.3.14 HET-P4 Bias for HET Detectors

Pin	Signal Name	Destination	Wire Type/Grouping
1	Guide pin tied to H1A BIAS		
2	H1A BIAS	H1A-P5 pin 5	Trace on rigid-flex cable
3	H1A BIAS	H1A-P5 pin 5	" " " "
4	H25A BIAS	H2A-P5 pin 5, H3A1-P5 pin 5, H3A2-P5 pin 5, H4A1-P5 pin 5, H4A2-P5 pin 5, H5A1-P5 pin 5, H5A2-P5 pin 5	" " " "
5	H25A BIAS	" " "	" " " "
6	H25B BIAS	H5B2-P5 pin 5, H5B1-P5 pin 5, H4B2-P5 pin 5, H4B1-P5 pin 5, H3B2-P5 pin 5, H3B1-P5 pin 5, H2B-P5 pin 5	" " " "
7	H25B BIAS	" " "	" " " "
8	H1B BIAS	H1B-P5 pin 5	" " " "
9	H1B BIAS	H1B-P5 pin 5	" " " "
10	Guide pin tied to H1B BIAS		

Note: This is a rigid-flex cable. HV&LV signal traces shall run sandwiched between GND planes that originate from the neighboring HET-P3 connector located on the same rigid-flex cable.

6.4 *Telescope Connector Pinouts*

Notes:

- These are rigid-flex cables running between telescopes and telescope boards located in E-box.
- Analog signal traces shall run sandwiched between GND planes that originate from -P3 connector located on the E-box end of each rigid-flex cable.
- Spare pin or its mate shall be tied to the neighboring pin so the mated pair doesn't float.
- As some connector pairs are flipped because of detectors being flipped, view the harness connector from the mating side when referring to the position #1 location described in the tables below.

6.4.1 L0A-P5 L0A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	L0Ac	LET1-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L0A BIAS	LET1-P4 pin 2	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L0Ab	LET1-P3 pin TBD	Trace on rigid-flex cable
7	L0Aa	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L0Ae	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L0Ad	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.2 L1A-P5 L1A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	L1Ac	LET1-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L1A BIAS	LET1-P4 pin 3	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L1Ab	LET1-P3 pin TBD	Trace on rigid-flex cable
7	L1Aa	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L1Ae	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L1Ad	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.3 L2A-P5 L2A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	L2Ac	LET1-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	L2A BIAS	LET1-P4 pin 4	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L2Ab	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L2Aa	LET1-P3 pin TBD	Trace on rigid-flex cable
9	L2Ae	LET1-P3 pin TBD	Trace on rigid-flex cable
10	L2Ag	LET1-P3 pin TBD	Trace on rigid-flex cable
11	L2Ap	LET1-P3 pin TBD	Trace on rigid-flex cable
12	L2Ad	LET1-P3 pin TBD	Trace on rigid-flex cable
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.4 L3A-P5 L3A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L34A BIAS	LET1-P4 pin 5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L3Ab	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L3Aa	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L3Ap	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.5 L4A-P5 L4A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L34A BIAS	LET1-P4 pin 5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L4Ab	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L4Aa	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L4Ap	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.6 L4B-P5 L4B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L34B BIAS	LET1-P4 pin 6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L4Bb	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L4Ba	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L4Bp	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.7 L3B-P5 L3B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L34B BIAS	LET1-P4 pin 6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L3Bb	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L3Ba	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L3Bp	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.8 L2B-P5 L2B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	LET1-P3 pin TBD	GND plane on rgd-flex cbl
3	L2Bc	LET1-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	L2B BIAS	LET1-P4 pin 7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L2Bb	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L2Ba	LET1-P3 pin TBD	Trace on rigid-flex cable
9	L2Be	LET1-P3 pin TBD	Trace on rigid-flex cable
10	L2Bg	LET1-P3 pin TBD	Trace on rigid-flex cable
11	L2Bp	LET1-P3 pin TBD	Trace on rigid-flex cable
12	L2Bd	LET1-P3 pin TBD	Trace on rigid-flex cable
13	AGND	LET1-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.9 L1B-P5 L1B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	L1Bc	LET1-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L1B BIAS	LET1-P4 pin 8	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L1Bb	LET1-P3 pin TBD	Trace on rigid-flex cable
7	L1Ba	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L1Be	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L1Bd	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.10 L0B-P5 L0B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	L0Bc	LET1-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L0B BIAS	LET1-P4 pin 9	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L0Bb	LET1-P3 pin TBD	Trace on rigid-flex cable
7	L0Ba	LET1-P3 pin TBD	Trace on rigid-flex cable
8	L0Be	LET1-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L0Bd	LET1-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.11 L0C-P5 L0C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	L0Cc	LET2-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L0C BIAS	LET2-P4 pin 2&9	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L0Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
7	L0Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L0Ce	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L0Cd	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.12 L1C-P5 L1C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	L1Cc	LET2-P3 pin TBD	Trace on rigid-flex cable
3	N/A (epoxy fill)		
4	L1C BIAS	LET2-P4 pin 3&8	Trace on rigid-flex cable
5	N/A (epoxy fill)		
6	L1Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
7	L1Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L1Ce	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L1Cd	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Guide pin mating cavity		

6.4.13 L2C-P5 L2C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET2-P3 pin TBD	GND plane on rgd-flex cbl
3	L2Cc	LET2-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	L2C BIAS	LET2-P4 pin 4&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L2Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L2Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
9	L2Ce	LET2-P3 pin TBD	Trace on rigid-flex cable
10	L2Cg	LET2-P3 pin TBD	Trace on rigid-flex cable
11	L2Cp	LET2-P3 pin TBD	Trace on rigid-flex cable
12	L2Cd	LET2-P3 pin TBD	Trace on rigid-flex cable
13	AGND	LET2-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.14 L3C-P5 L3C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET2-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L36C BIAS	LET2-P4 pin 5&6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L3Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L3Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L3Cp	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET2-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.15 L4C-P5 L4C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	LET2-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L36C BIAS	LET2-P4 pin 5&6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L4Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L4Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L4Cp	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET2-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.16 L5C-P5 L5C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	LET2-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L36C BIAS	LET2-P4 pin 5&6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L5Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L5Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L5Cp	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET2-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.17 L6C-P5 L6C Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	LET2-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	L36C BIAS	LET2-P4 pin 5&6	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	L6Cb	LET2-P3 pin TBD	Trace on rigid-flex cable
8	L6Ca	LET2-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	Spare		
11	L6Cp	LET2-P3 pin TBD	Trace on rigid-flex cable
12	Spare		
13	AGND	LET2-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.18 H1A-P5 H1A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	H1Ac	HET-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	H1A BIAS	HET-P4 pin 2&3	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	H1Ab	HET-P3 pin TBD	Trace on rigid-flex cable
8	H1Aa	HET-P3 pin TBD	Trace on rigid-flex cable
9	H1Ae	HET-P3 pin TBD	Trace on rigid-flex cable
10	H1Ag	HET-P3 pin TBD	Trace on rigid-flex cable
11	Spare		
12	H1Ad	HET-P3 pin TBD	Trace on rigid-flex cable
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.19 H2A-P5 H2A Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	H2Ac	HET-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	H2Ab	HET-P3 pin TBD	Trace on rigid-flex cable
8	H2Aa	HET-P3 pin TBD	Trace on rigid-flex cable
9	H2Ae	HET-P3 pin TBD	Trace on rigid-flex cable
10	H2Ag	HET-P3 pin TBD	Trace on rigid-flex cable
11	H2Ap	HET-P3 pin TBD	Trace on rigid-flex cable
12	H2Ad	HET-P3 pin TBD	Trace on rigid-flex cable
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.20 H3A1-P5 H3A1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H3Aa (mates with H3A1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H3Ag (mates with H3A1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H3Ag (mates with H3A1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H3Ag (mates with H3A1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.21 H3A2-P5 H3A2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H3Aa (mates with H3A2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H3Ag (mates with H3A2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H3A2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H3Ag (mates with H3A2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.22 H4A1-P5 H4A1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H4Aa (mates with H4A1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H4Ag (mates with H4A1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H4Ag (mates with H4A1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H4Ag (mates with H4A1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.23 H4A2-P5 H4A2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H4Aa (mates with H4A2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H4Ag (mates with H4A2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H4A2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H4Ag (mates with H4A2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.24 H5A1-P5 H5A1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H5Aa (mates with H5A1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H5Ag (mates with H5A1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H5Ag (mates with H5A1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H5Ag (mates with H5A1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.25 H5A2-P5 H5A2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25A BIAS	HET-P4 pin 4&5	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H5Aa (mates with H5A2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H5Ag (mates with H5A2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H5A2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H5Ag (mates with H5A2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.26 H5B2-P5 H5B2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H5Ba (mates with H5B2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H5Bg (mates with H5B2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H5B2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H5Bg (mates with H5B2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.27 H5B1-P5 H5B1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H5Ba (mates with H5B1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H5Bg (mates with H5B1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H5Bg (mates with H5B1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H5Bg (mates with H5B1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.28 H4B2-P5 H4B2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H4Ba (mates with H4B2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H4Bg (mates with H4B2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H4B2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H4Bg (mates with H4B2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.29 H4B1-P5 H4B1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H4Ba (mates with H4B1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H4Bg (mates with H4B1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H4Bg (mates with H4B1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H4Bg (mates with H4B1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.30 H3B2-P5 H3B2 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H3Ba (mates with H3B2a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H3Bg (mates with H3B2go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H3B2p	HET-P3 pin TBD	Trace on rigid-flex cable
12	H3Bg (mates with H3B2gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.31 H3B1-P5 H3B1 Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	Spare		
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	Spare		
8	H3Ba (mates with H3B1a)	HET-P3 pin TBD	Trace on rigid-flex cable
9	Spare		
10	H3Bg (mates with H3B1go)	HET-P3 pin TBD	Trace on rigid-flex cable
11	H3Bg (mates with H3B1p)	HET-P3 pin TBD	Shares trace with pin 10
12	H3Bg (mates with H3B1gi)	HET-P3 pin TBD	Shares trace with pin 10
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.32 H2B-P5 H2B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on RIGHT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	H2Bc	HET-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	H25B BIAS	HET-P4 pin 6&7	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	H2Bb	HET-P3 pin TBD	Trace on rigid-flex cable
8	H2Ba	HET-P3 pin TBD	Trace on rigid-flex cable
9	H2Be	HET-P3 pin TBD	Trace on rigid-flex cable
10	H2Bg	HET-P3 pin TBD	Trace on rigid-flex cable
11	H2Bp	HET-P3 pin TBD	Trace on rigid-flex cable
12	H2Bd	HET-P3 pin TBD	Trace on rigid-flex cable
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

6.4.33 H1B-P5 H1B Detector Signals and Bias

Pin	Signal Name	Destination	Wire Type/Grouping
1	Gd pin mt cavity, pos #1 on LEFT		
2	AGND	HET-P3 pin TBD	GND plane on rgd-flex cbl
3	H1Bc	HET-P3 pin TBD	Trace on rigid-flex cable
4	N/A (epoxy fill)		
5	H1B BIAS	HET-P4 pin 8&9	Trace on rigid-flex cable
6	N/A (epoxy fill)		
7	H1Bb	HET-P3 pin TBD	Trace on rigid-flex cable
8	H1Ba	HET-P3 pin TBD	Trace on rigid-flex cable
9	H1Be	HET-P3 pin TBD	Trace on rigid-flex cable
10	H1Bg	HET-P3 pin TBD	Trace on rigid-flex cable
11	Spare		
12	H1Bd	HET-P3 pin TBD	Trace on rigid-flex cable
13	AGND	HET-P3 pin TBD	Shares GND plane w/ pin 2
14	Guide pin mating cavity		

7. Harness Physical Properties

7.1 *Length, Diameter, Mass (estimated and/or measured)*

Thermal Harness

Section	Connecting	Length	Bundle Diameter	Mass
S/C RTDs	EPH-J3 to S/C RTDs	xx cm (xx")	x.x mm (0.xxx")	xxx g
Surv heater	EPH-J4 to Surv htr hdwr	xx cm (xx")	x.x mm (0.xxx")	xxx g
Oper heater	EPH-P5 to Oper htr hdwr	xx cm (xx")	x.x mm (0.xxx")	xxx g
Total:				xxx g

7.2 *Bending Radii*

Bending radii are important property of each harness and shall be maximized during harness routing to prevent damage to wire/insulation. Expertise from JPL in this area shall be utilized to the extent possible.

7.3 *Cross Sectional Drawings*

Shown on the following pages will be cross sectional drawings of each harness bundle with estimated diameters when harness designs are more mature.

8. Harness Responsibilities

Harness responsibilities are listed in sub-titles of connector pinouts in Sections 6.1 and 6.2. Caltech is responsible for building all intra-instrument harnesses in Sections 6.3 and 6.4 (those sub-titles have been eliminated to save space). JHU/APL is responsible for building all S/C harnesses.

Appendix 1 *GSE and I&T Cables*

(will be added to the following pages in the future)

Appendix 2 *Manufacturer datasheets*

(will be added to the following pages in the future)