

# HIRDLS



## HIGH RESOLUTION DYNAMICS LIMB SOUNDER

Originator: Lucy Lanham

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**Oxford University  
Atmospheric, Oceanic & Planetary Physics  
Parks Road  
OXFORD OX1 3PU  
United Kingdom**

**University of Colorado at Boulder  
Center for Limb Atmospheric Sounding  
3300 Mitchell Lane, Suite 250  
Boulder, Colorado 80301-2296  
United States of America**

---

**Advanced Technology Center  
Lockheed Martin Space Systems  
Missiles & Space Operations  
3251 Hanover Street  
Palo Alto, CA 94304-1191  
United States of America**

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**SP-HIR-249**  
**TSS to PSS Interface Control Document (ICD)**

Approved by: \_\_\_\_\_  
/s/ John G. Whitney, HIRDLS Program System Engineer Date

\_\_\_\_\_  
/s/ Raymond L. von Savoye, HIRDLS Instrument System Engineer Date

\_\_\_\_\_  
/s/ Nigel Morris, UK Program Manager Date

\_\_\_\_\_  
/s/ Peter Dean , TSS Responsible Equipment Engineer Date

## Change Log

Rev	Date	Section	Change Description
N/R	98-10-06	All	Initial Release
A	00-06-02	sig. page	Updated to reflect current program responsibilities
		2.1	Provided release dates for referenced documents
		3.2.2.1	Corrected nomenclature for TEU_28QC
		Table 3.2.2.3-1	Changed to TEU only Table Added voltage at TEU end of cable, updated cable resistance. Changed Max resistance (deleted freq. range) Corrected freq. at which spikes occur Modified note 5.
		Table 3.2.2.3-2	Created an EEA only Table. Changed Max resistance (deleted freq. range) Corrected freq. at which spikes occur Modified note 5.
		Table 3.2.5.2-2	Corrected EEA Connector functions of first 5 pins
		Figure 3.2.2.5-1	Corrected PCU return and ground depiction
		Figure 3.2.2.5-2	Corrected PCU return and ground depiction
B	01-04-12	2.1	Deleted SP-HIR-103, C&TH. This document is no longer called out in the ICD. (CR204) Deleted reference to GIRD and UIID. These documents are not called out in the ICD. (CR204)
		Figure 3.1-1	Removed accelerometers from block diagram. (CR204)
		3.2.2.1	Deleted reference to C&TH. IPU to PSS commands are not applicable to this interface control document. (CR204)
		3.2.2.2	Deleted reference to C&TH. IPU to PSS commands are not applicable to this interface control document. (CR204)
		3.2.2.3	Added text to define maximum and minimum voltage conditions for TEU and EEA. (CR204)
		Table 3.2.2.3-1	Updated TEU voltage and current characteristics for +5V. (CR204) Added line for Minimum voltage rise times. (CR204)
		Table 3.2.2.3-3	Updated EEA voltage characteristics for +5V. (CR204) Added line for Minimum voltage rise times. (CR204)
		3.2.2.4	Added section to define inrush current. (CR204)
		3.2.2.5	Renumbered section. (CR204)
		3.2.2.6	Renumbered section. (CR204)
	01-06-11	3.2.2.6	Figure 3.2.2.6-1 Modified to reflect naming convention of star points and grounding studs external to PCU (RE comments to CR204)

Rev	Date	Section	Change Description	Approved
C	01-11-30	3.2.2.3	Table 3.2.2.3-2, PCU to EEA Power Characteristics. Change nominal and max –15V power to 82 and 86 mA respectively. (CR231)	<i>Signed copy on file</i>  Timothy J. Crews  Peter Dean  John Whitney  Nigel Morris

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## 1 SCOPE

Interface Control Documents (ICDs) in the SP-HIR-2XX series define, as applicable, the specific design implementations of the electrical, functional, mechanical, conductive thermal, and optical interfaces between specified HIRDLS Subsystems or, in a few special cases, between units within the same subsystem.

This ICD defines the specific design implementation of the interfaces between the Telescope Subsystem (TSS) and the Power Supply Subsystem (PSS). The interfaces between these two subsystems are limited to the Electrical interfaces between the Power Converter Unit (PCU) and Telescope Electronics Unit (TEU), and between the PCU and Encoder Electronics Assembly (EEA).

## 2 DOCUMENT REFERENCES

### 2.1 Applicable Documents

The documents listed below are a part of this ICD to the extent specified herein. In the case of a conflict between the contents of this ICD and any Applicable Document, this ICD shall take precedence.

GSFC 424-12-21-013	Instrument Technical Specification (ITS)	February 2000
SP-HIR-169G	HIRDLS Power Distribution, Switching and Grounding	00-02-01
SP-HIR-200G	Internal Interface Control Document (IICD) (System Section)	97-12-01

### 2.2 Information Documents

The documents listed below are for information only and are explicitly not, by reference, part of this ICD.

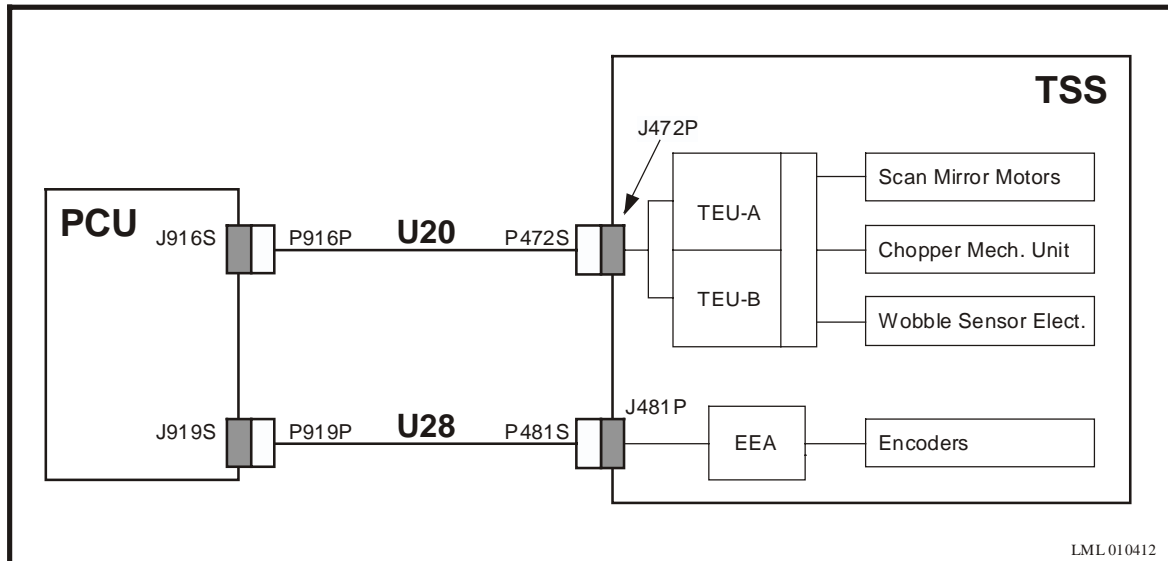
SP-HIR-036	Power Supply Subsystem Specification Document	Current Revision
SP-HIR-040	Telescope Subsystem Specification Document	Current Revision

### 3 INTERFACE REQUIREMENTS

#### 3.1 Interface Concept Overview

The electrical interface between the TSS and the PSS consists of power and grounding connections only. There are no mechanical, thermal, optical, or data interfaces between them. The PCU shall provide switched primary and secondary power to the TEU, and switched secondary power to the EEA.

A top-level block diagram of the TSS-PSS interface is shown in Figure 3.1-1.



**Figure 3.1-1 TSS-PSS Interface Block Diagram**

#### 3.2 Electrical Interface

##### 3.2.1 Grounding and Shielding

###### 3.2.1.1 Primary and Secondary Power Grounding and Isolation

Primary power returns shall be isolated from all other returns and from chassis ground by 10.0 MΩ dc or greater; secondary power returns shall be isolated from the primary power returns by 10.0 MΩ dc or greater. The configuration of all grounds and returns within the PCU and the TSS, and their interconnections across the PSS-TSS interface, shall conform to SP-HIR-169.

###### 3.2.1.2 Signal Grounds

N/A

###### 3.2.1.3 Equipment Enclosure Grounding, Shielding, and Bonding

Refer to SP-HIR-214 for TSS equipment enclosure grounding.

### 3.2.1.4 Wire and Cable Shield Grounds

Cables shall have an overall shield connected to chassis ground through the connector shells at both ends of the cable. Internal shields (if any) for groups of conductors within cables shall be insulated from other internal shields and from the overall shield, and shall be connected via connector pins as indicated in the relevant interconnection diagrams and pinout tables.

## 3.2.2 Power Interface

### 3.2.2.1 Primary Power

The PCU shall furnish separately switched, unregulated Quiet Bus power (referred to as “A\_TEU\_28QC” and “B\_TEU\_28QC”) to the A and B sides of the TEU. The primary power switching arrangement shall conform to SP-HIR-169.

### 3.2.2.2 Secondary Power

The PCU shall supply switched, regulated secondary power to the TSS as follows:

- The PCU shall supply separately switched +5 V and  $\pm 15$  V power to the A and B sides of the TEU.
- The PCU shall supply non-redundant switched +5 V and  $\pm 15$  V power to the EEA.

Power converter assignments and switching arrangements within the PCU shall conform to SP-HIR-169.

### 3.2.2.3 Power Characteristics

Power delivered to the TSS by the PCU shall conform to the regulation, ripple, and noise characteristics shown in Table 3.2.2.3-1 and 3.2.2.3-2. TEU load currents shall not exceed the limits shown in Table 3.2.2.3-1. Maximum voltages to the TEU shall apply with only the TEU powered (EEA & GSS are off) as controlled by the PCU. Minimum voltages to the TEU shall apply with the TEU, EEA and GSS powered. EEA load currents shall not exceed the limits shown in Table 3.2.2.3-2. Maximum voltages to the EEA shall apply with the TEU & EEA on and with the GSS off. Minimum EEA voltages shall apply with the TEU, EEA and GSS powered.

**Table 3.2.2.3-1 PCU to TEU Power Characteristics**

	+5V	+15V	-15V	28QC	See Note
Voltage limits at PCU end of cable	+5.15 +5.25	+15.05 +15.35	-15.10 -15.40	+24.00 +35.00	1
Voltage limits at TEU end of cable	5.05 5.15	+15.00 +15.30	-15.05 -15.35	+23.90 +35.00	
TEU Nominal DC load current (mA)	660	307	279	347	2
TEU Maximum DC load current (mA)	660 (1150 for 400ms)	307	279	672	2
Maximum resistance of cable + connector pins	150 m $\Omega$	150 m $\Omega$	150 m $\Omega$	150 m $\Omega$	
Maximum PCU supply output resistance	100 m $\Omega$	100 m $\Omega$	100 m $\Omega$		3, 5
PCU-induced spikes at PCU end of cable	<150 mV peak	<150 mV peak	<150 mV peak		6
PCU-induced ripple at PCU end of cable	<20 mV peak	<20 mV peak	<20 mV peak		4
Voltage rise time	500 $\mu$ s	N/A	800 $\mu$ s	N/A	7, 8

**Table 3.2.2.3-2 PCU to EEA Power Characteristics**

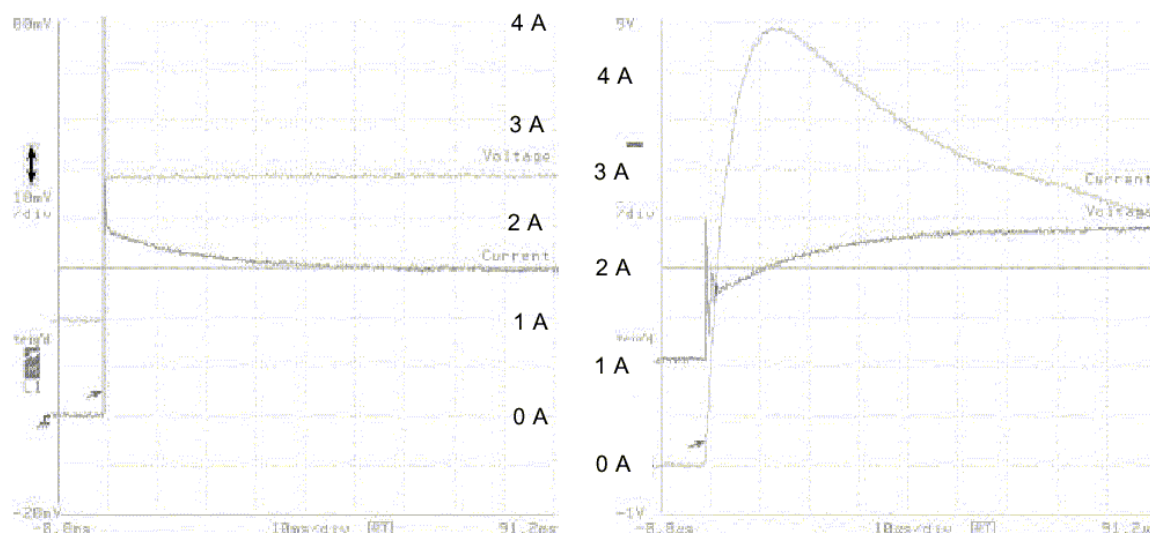
	+5V	+15V	-15V	See Note
Voltage limits at PCU end of cable	+5.15 +5.25	+15.05 +15.35	-15.10 -15.40	1
Voltage limits at EEA end of cable	4.95 5.08	+15.00 +15.30	-15.05 -15.35	
EEA Nominal DC load current (mA)	400	105	<del>608</del> 2	2
EEA Maximum DC load current (mA)	400	105	<del>608</del> 6	2
Maximum resistance of cable + connector pins	500 m $\Omega$	500 m $\Omega$	500 m $\Omega$	
Maximum PCU supply output resistance	100 m $\Omega$	100 m $\Omega$	100 m $\Omega$	3 5
PCU-induced spikes at PCU end of cable	<150 mV peak	<150 mV peak	<150 mV peak	6
PCU-induced ripple at PCU end of cable	<20 mV peak	<20 mV peak	<20 mV peak	4
Voltage rise time	325 $\mu$ s	700 $\mu$ s	600 $\mu$ s	

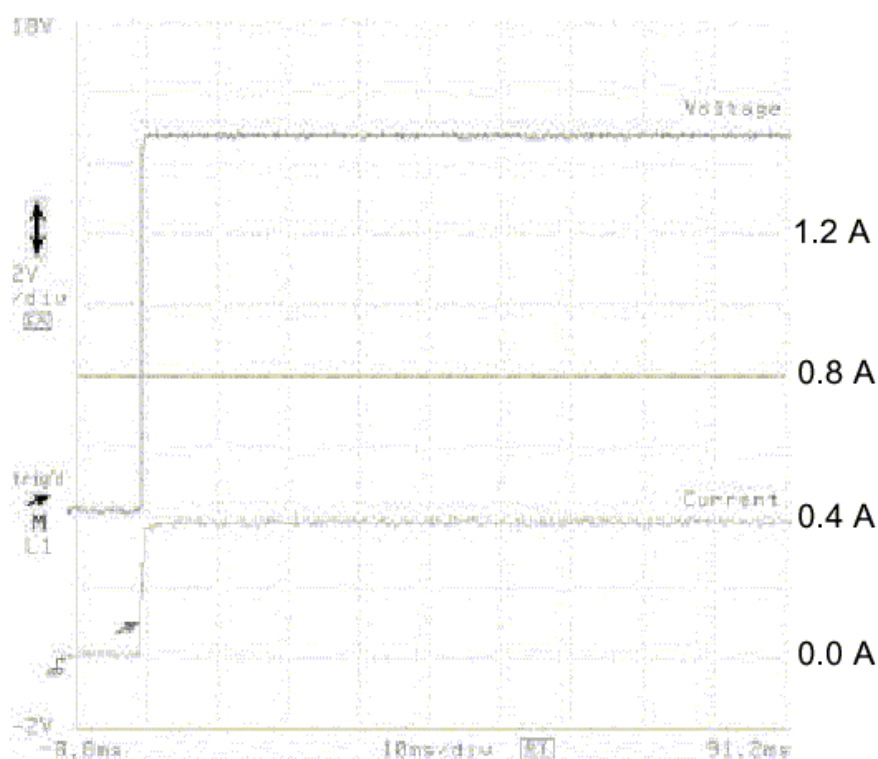
**Notes**

1. At specified maximum DC load current
2. In this context, "DC" means for time periods longer than 5 s.
3. At beginning of life
4. Over a bandwidth of 0-5 MHz
5. 200 m $\Omega$  at end of life
6. At the switching frequency
7. On power turn-on
8. Voltage rise time for +15V and 28QC is determined by the speed of the contact closure.

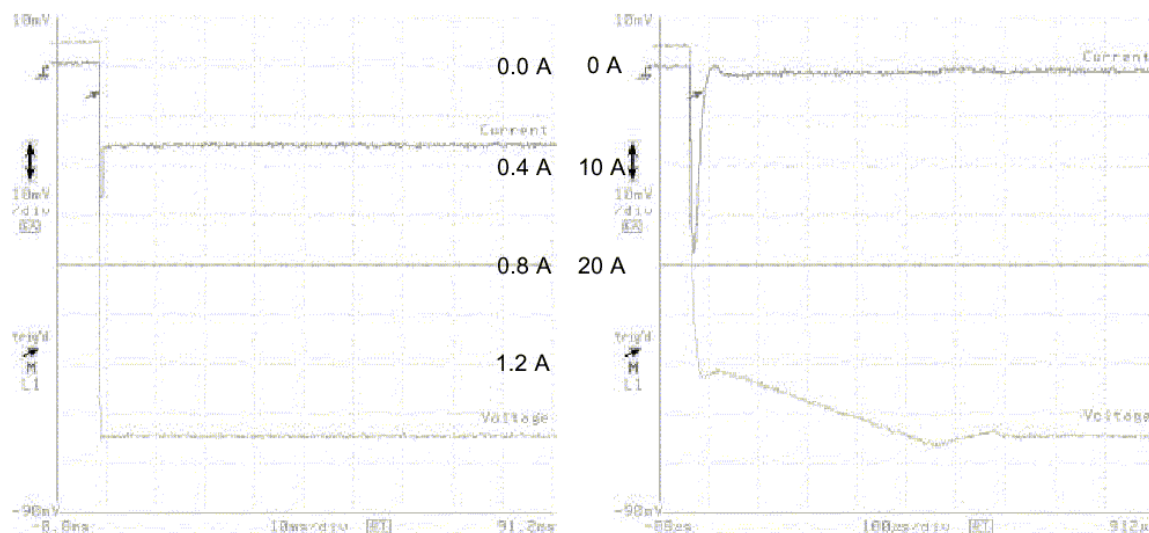
**3.2.2.4 Inrush Current**

The PCU shall perform to all requirements when connected to the TSS having the capability of sinking inrush currents as shown in Figures 3.2.2.4-1 through 3.2.2.4-7.

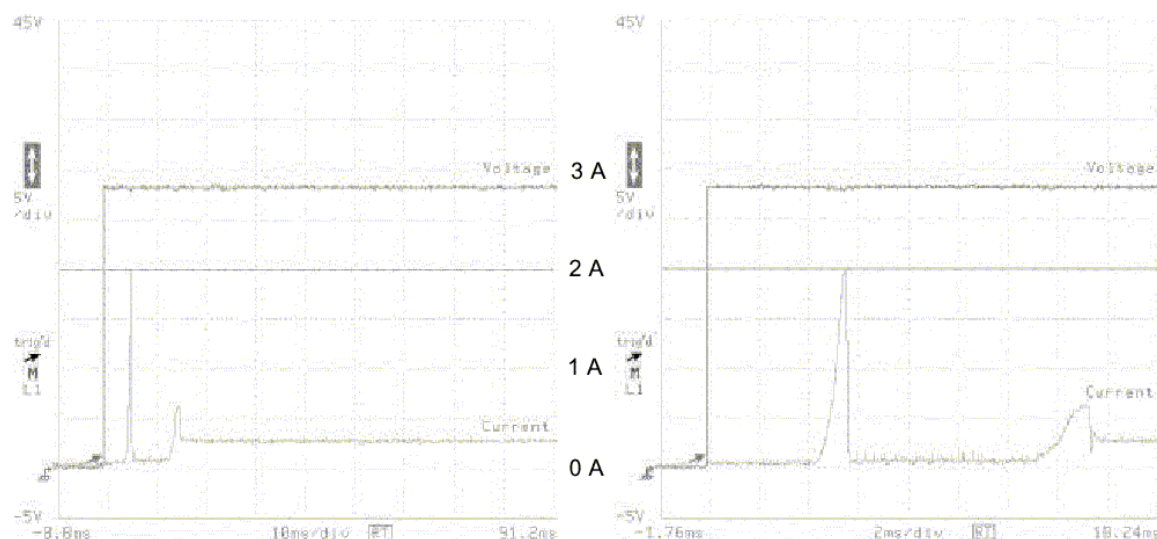
**Figure 3.2.2.4-1 TEU 5V Inrush When Driven by an Ideal Power Supply**



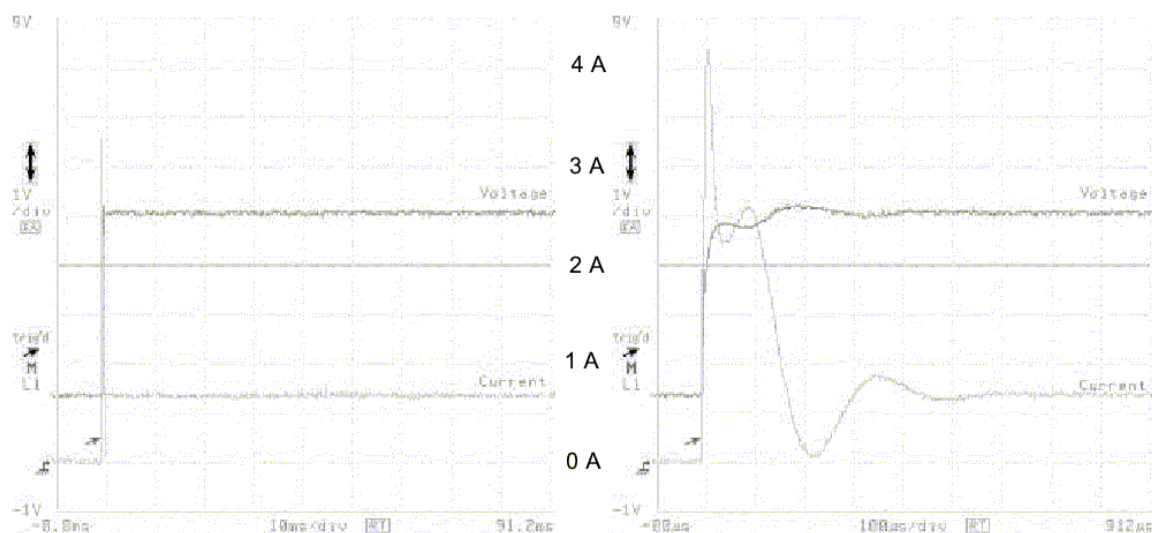
**Figure 3.2.2.4-2 TEU 15V Inrush When Driven by an Ideal Power Supply**



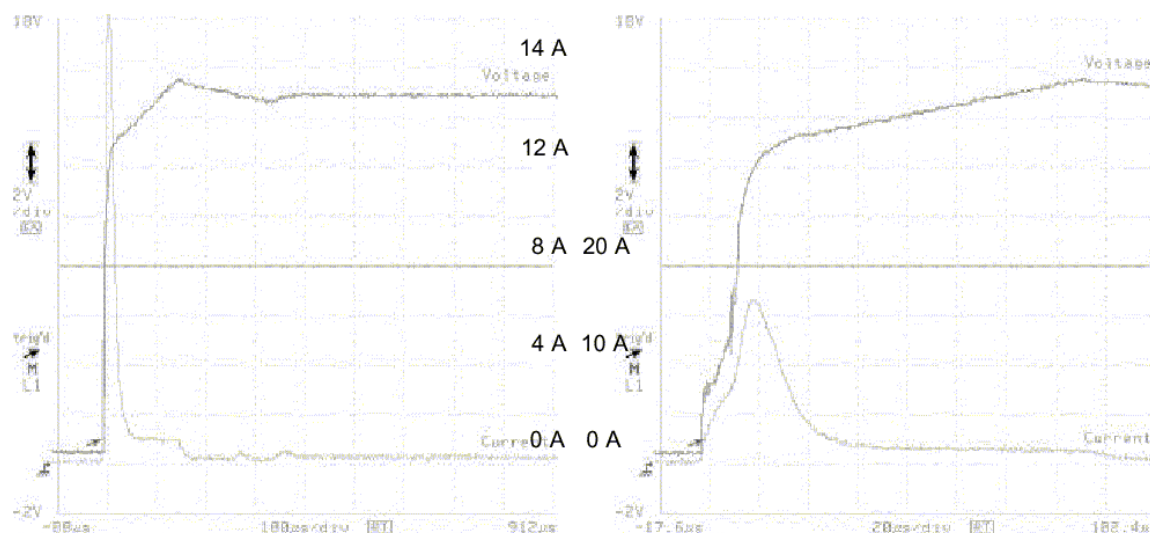
**Figure 3.2.2.4-3 TEU -15V Inrush When Driven by an Ideal Power Supply**



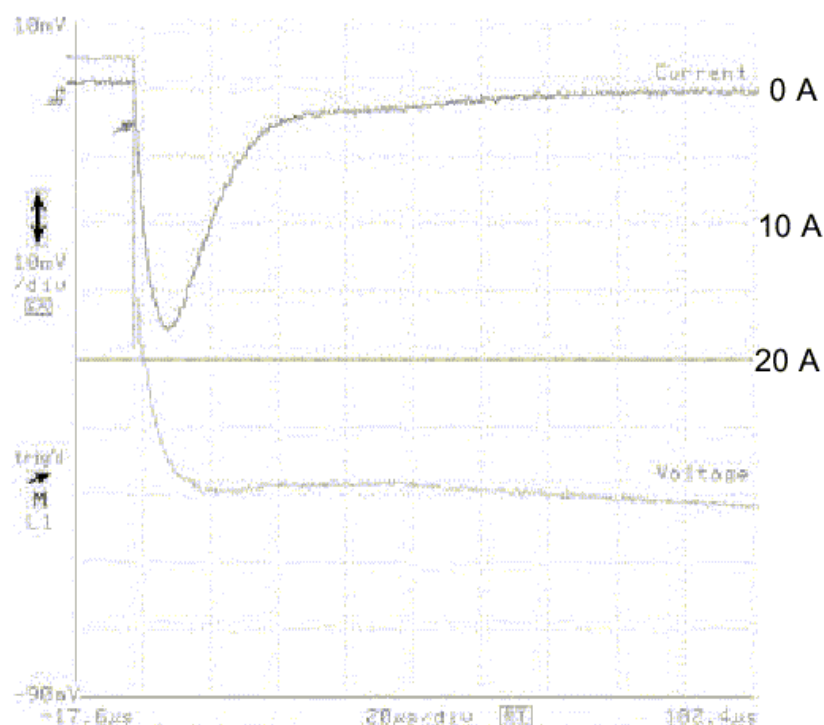
**Figure 3.2.2.4-4 TEU 28V Inrush When Driven by an Ideal Power Supply**



**Figure 3.2.2.4-5 EEA 5V Inrush When Driven by an Ideal Power Supply**



**Figure 3.2.2.4-6 EEA 15V Inrush When Driven by an Ideal Power Supply**



**Figure 3.2.2.4-7 EEA -15V Inrush When Driven by an Ideal Power Supply**

### **3.2.2.5 Fault Tolerance**

The TSS shall not be damaged by sustained voltages below the minimum indicated in Table 3.2.2.3-1 nor by the unannounced removal of power on any supply line. The TSS and PCU shall not be damaged by the simultaneous turn-on of both the A-side and B-side spacecraft bus inputs. The PCU shall not be damaged by the shorting of any secondary power output line to ground. The TSS shall not be damaged by the shorting of any supply line to ground.

### **3.2.2.6 PSS-TSS Interface Diagrams**

The PCU-TEU interface shall consist of the power interface via Cable U20 as shown in Figure 3.2.2.5-1. The PCU-EEA interface shall consist of the power interface via Cable U28 as shown in Figure 3.2.2.5-2.

### **3.2.3 Control and Data**

N/A

### **3.2.4 Analog Monitors**

N/A



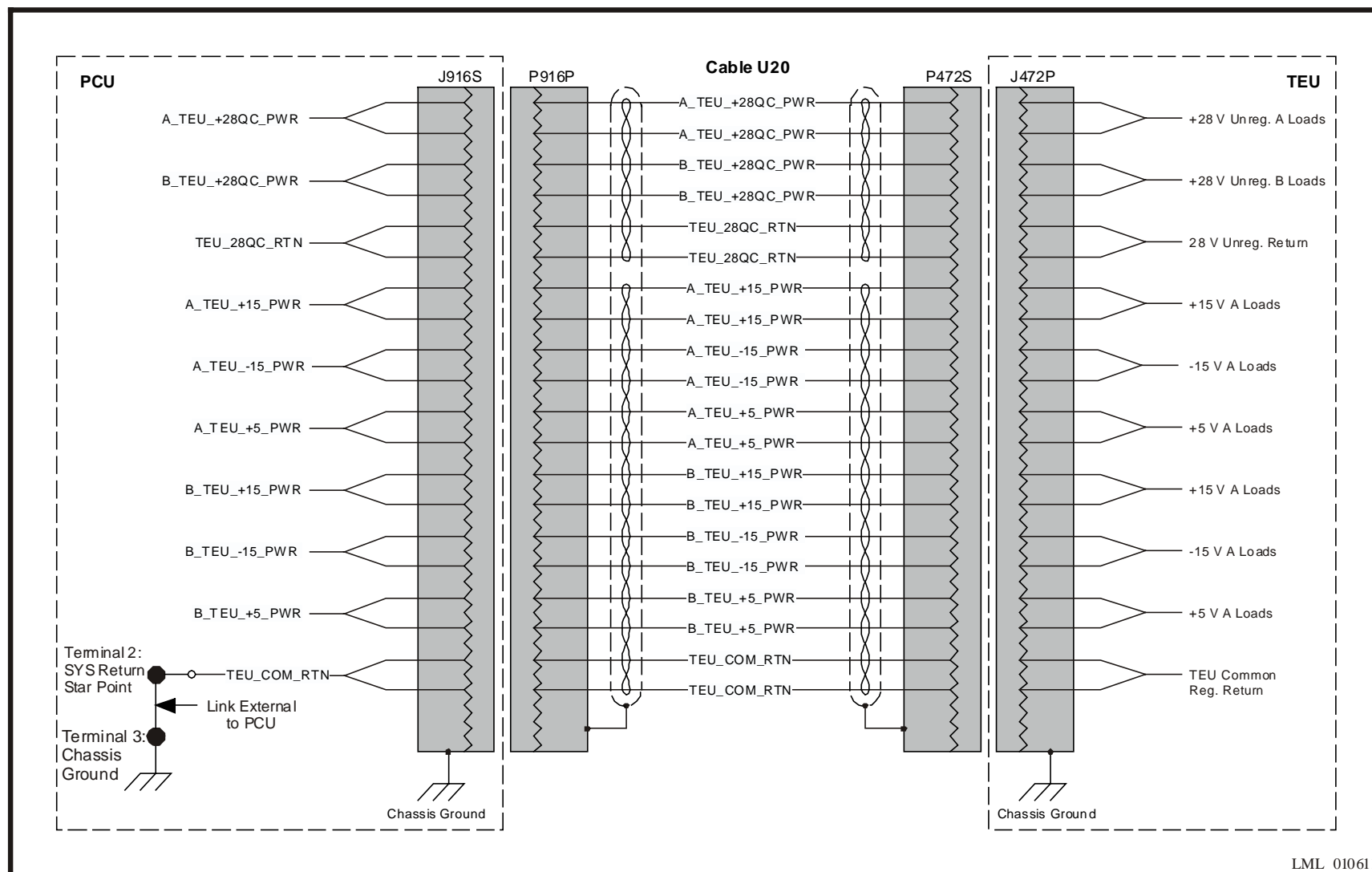
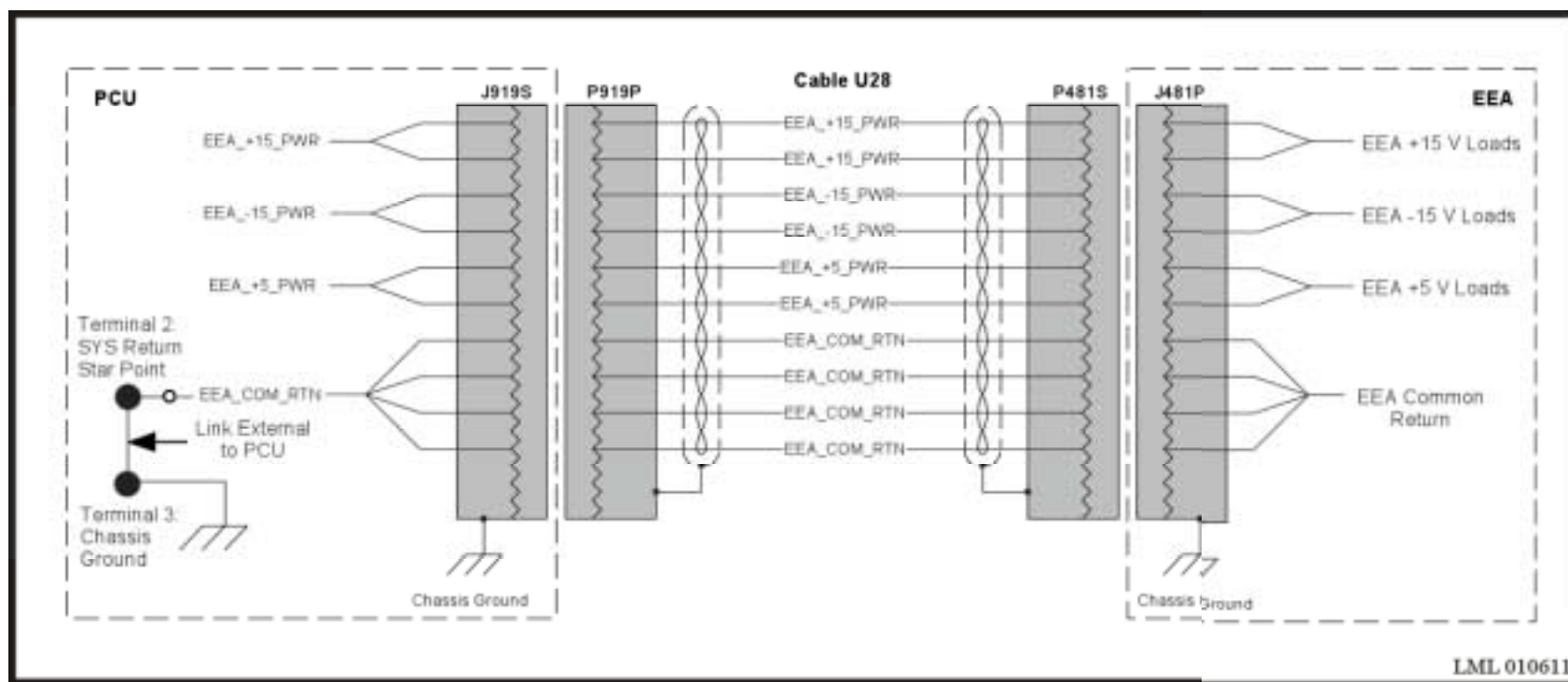


Figure 3.2.2.5-1 PCU-TEU Power Interface Cable Configuration



**Figure 3.2.2.5-2 PCU-EEA Power Interface Cable Configuration**

### 3.2.5 Physical Electrical Interface

#### 3.2.5.1 Connector Type Definitions

Connectors hard mounted on boxes or the structure are referred to as “jacks” (or “receptacles”) and will have the letter “J” preceding the connector number. Connectors located on harnesses, cables or wires will be referred to as “plugs” and will have the letter “P” preceding the connector number. The letter “S” or “P” at the end of the connector number specifies contact type: “S” for socket and “P” for pin.

Connector types used for the TSS-PSS electrical interfaces are defined in Table 3.2.5.1-1.

**Table 3.2.5.1-1 Connector Types**

<b>Jack No.</b>	<b>Location</b>	<b>PPL-21 Type</b>	<b>Pins</b>	<b>Plug No.</b>	<b>Cable</b>	<b>PPL-21 Type</b>
J916S	PCU	311P409-3S-B12	25	P916P	U20	311P409-3P-B12
J472P	TEU	311P409-3P-B12	25	P472S	U20	311P409-3S-B12
J919S	PCU	311P407-1S-B12	15	P919P	U28	311P407-1P-B12
J481P	EEA	M83513/10-B01NP*	15	P481S	U28	M83513/04-B16N*

\*Not a PPL type

#### 3.2.5.2 Connector Pinout Definitions

Signal names and pin assignments for Cables U20 (PCU to TEU Power) and U28 (PCU-EEA Power) are defined in Tables 3.2.5.2-1 and 3.2.5.2-2.

**Table 3.2.5.2-1 Cable U20 (PCU to TEU Power)**

PCU							TEU	
P916P	<————Cable U20 ———>						P472S	
J916S	<————Box Receptacles ———>						J472P	
PIN	SIGNAL NAME	TYPE	V <sub>max</sub> V	I <sub>max</sub> mA	GROUP	WIRE TYPE	PIN	FUNCTION
1	Blank						1	
2	A_TEU_+28QC_PWR	Power	42	680	T6-1A	*	2	Unregulated +28V Power Side A
3	TEU_28QC_RTN	Pwr Rtn	0	680	T6-1C	*	3	Unregulated 28V Power Return
4	B_TEU_+28QC_PWR	Power	42	680	T6-1E	*	4	Unregulated +28V Power Side B
5	Blank						5	
6	A_TEU_+15_PWR	Power	16	310	T14-1A	*	6	Regulated +15 V Power Side A
7	A_TEU_-15_PWR	Power	16	280	T14-1C	*	7	Regulated -15 V Power Side A
8	B_TEU_+15_PWR	Power	16	310	T14-1E	*	8	Regulated +15 V Power Side B
9	B_TEU_-15_PWR	Power	16	280	T14-1G	*	9	Regulated -15 V Power Side B
10	A_TEU_+5_PWR	Power	6	1200	T14-1J	*	10	Regulated +5 V Power Side A
11	B_TEU_+5_PWR	Power	6	1200	T14-1L	*	11	Regulated +5 V Power Side B
12	TEU_COM_RTN	Pwr Rtn	0	1510	T14-1N	*	12	TEU Common Reg. Power Return
13	Blank						13	
14	Blank						14	
15	A_TEU_+28QC_PWR	Power	42	680	T6-1B	*	15	Unregulated +28 V Power Side A
16	TEU_28QC_RTN	Pwr Rtn	0	680	T6-1D	*	16	Unregulated 28 V Power Return
17	B_TEU_+28QC_PWR	Power	42	680	T6-1F	*	17	Unregulated +28 V Power Side B
18	Blank						18	
19	A_TEU_+15_PWR	Power	16	310	T14-1B	*	19	Regulated +15 V Power Side A
20	A_TEU_-15_PWR	Power	16	280	T14-1D	*	20	Regulated -15 V Power Side A
21	B_TEU_+15_PWR	Power	16	310	T14-1F	*	21	Regulated +15 V Power Side B
22	B_TEU_-15_PWR	Power	16	280	T14-1H	*	22	Regulated -15 V Power Side B
23	A_TEU_+5_PWR	Power	6	1200	T14-1K	*	23	Regulated +5 V Power Side A
24	B_TEU_+5_PWR	Power	6	1200	T14-1M	*	24	Regulated +5 V Power Side B
25	TEU_COM_RTN	Pwr Rtn	0	1510	T14-1P	*	25	TEU Common Reg. Power Return
shell	Overall Shield	Shield					shell	U20 Overall Cable shield to Chassis
*	M22759/33-22-9							

**Table 3.2.5.2-2 Cable U28 (PCU to EEA Power)**

PCU							EEA	
<————Cable U28————>							P481S	
<————Box Receptacles————>							J481P	
PIN	SIGNAL NAME	TYPE	Vmax V	Imax mA	GROUP	WIRE TYPE	PIN	FUNCTION
1	EEA_+5_PWR	Power	6	500	T10-1A	*	2	EEA +5 V Power
2	EEA_+5_PWR	Power	6	500	T10-1B	*	3	EEA +5 V Power
3	EEA_+15_PWR	Power	16	110	T10-1C	*	4	EEA +15 V Power
4	EEA_+15_PWR	Power	16	110	T10-1D	*	5	EEA +15 V Power
5	Blank						1	Spare
6	Blank						6	Spare
7	EEA_COM_RTN	Pwr Rtn	0	610	T10-1E	*	7	EEA Common Reg. Power Return
8	EEA_COM_RTN	Pwr Rtn	0	610	T10-1F	*	8	EEA Common Reg. Power Return
9	EEA_COM_RTN	Pwr Rtn	0	610	T10-1G	*	9	EEA Common Reg. Power Return
10	EEA_COM_RTN	Pwr Rtn	0	610	T10-1H	*	10	EEA Common Reg. Power Return
11	Blank						11	Spare
12	Blank						12	Spare
13	EEA_-15_PWR	Power	16	80	T10-1J	*	13	EEA -15 V Power
14	EEA_-15_PWR	Power	16	80	T10-1K	*	14	EEA -15 V Power
15	Blank						15	Spare
shell	Overall Shield	Shield					shell	U28 Overall Shield to Chassis
*	#26 AWG per MIL-W-16878 Type E Teflon							

**3.3 Functional Interface**

N/A

**3.4 Mechanical Interface**

N/A

**3.5 Thermal Interface**

N/A

**3.6 Optical Interface**

N/A

**3.7 Other Interfaces**

N/A

**4 ABBREVIATIONS & ACRONYMS**

EEA	Encoder Electronics Assembly
GSS	Gyroscope Subsystem
ICD	Interface Control Document
ITS	Instrument Technical Specification
PCU	Power Converter Unit
PSS	Power Subsystem
TBD	To Be Determined
TEU	Telescope Electronics Unit
TSS	Telescope Subsystem