Far Ultraviolet SpectroPolarimeter (FUSP)

Telemetry, Commands, and Electrical Interface Specification

1100-S-0000
Revision H
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Vehicle
36.173UG

Prepared for:

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Change History

Rev	Date	Description
A	2 Dec, 1998	Original. Markup from WISP
B	2 Nov, 1999	Design Review; delete markup; rename connectors per Wallops; add ST3; add fiberoptic 2 MHz umbilical
C	14 Jan, 2000	After Design Review; update connector types, numbers; add P/J 900, and fiber-optic umbilical
D	6 Mar, 2001	Eliminate fiber-optic umbilical, consolidate multiple Star Tracker connectors into J714, update analog TM monitor assignments.
E	26 Apr, 2001	Rename "DTC" umbilical twisted pairs to "USE" designation; label changes only (J900 and J980).
F	26 Feb, 2002	Incorporate fiber optic umbilical data link. Label changes J980 and J981. Add signals and power for TM fiber optic transmitter module to J981
G	12 June, 2003	Label changes of TM monitors on J981. Add TM monitor of Acquire Command ST2 on J714
H	7 Apr, 2006	Original Ball Tracker (ST1) eliminated. ST1 is now aft looking ST5000 MkIID. ST2 is now ZOD ST5000 MkIID. ST1 control electronics is in ACS section, sensor in experiment vacuum section. New star tracker interface on experiment connector deck: see connector table, figure 1, section 4.3.

1. Telemetry

The telemetry interface will be compatible with the Vector Pulse Code Modulation (PCM) telemetry system used on sounding rockets. The purpose of this system is to transmit CCD images and engineering data from the payload. The science data rates are 1 pixel (15 bits) every 22.5 μsec, so that a high rate PCM system is required. The payload will transmit a NRZ-L 2 pole filtered data stream at a continuous 2 MHz rate to the TM section. The clock is generated within the payload. The data is arranged in packets, or frames. There are 10 words per science data frame. Each word is 9 bits wide. Each frame contains a fixed pattern 10 bit sync word, a 10 bit CCD line counter, a 10 bit telemetry frame counter, a 3 bit ID that indicates the type of data being sent, and 6 data bytes. (Parity is not transmitted during sync word, i.e., the PCM receiver will see the recommended 10 bit sync word as given in the PCM Handbook, NASA publication 1171 Table 19.) The data frame will have the following format:

Science Data Frame (SDF)

0 0 0 1 1 1 0 1 1 (Sync)				
P	Line Cnt(7)			0 (Sync)
P	Science Data (MS byte Pixel A)			
P	Science Data (LS byte Pixel A)			
P	Engineering Data			
P	Engineering Data			
P	Science Data (MS byte Pixel B)			
P	Science Data (LS byte Pixel B)			
P	SDF Cnt(5)		Line Cnt(3)	
P	SDB(1)	SDA(1)	ED(1)	SDF Cnt(5)

Note:

- Parity (P) is odd and is transmitted last.
- Frame period is 45 μsec.
- Data is shifted out to the right MSB first, starting with Sync.
- ED, SDA, SDB are ID status bits indicating, if "1", data in frame.

The ground station(s) will record the data on tape and provide a CDROM following the launch. During the test, pre-launch, and launch phases, the experiment GSE will receive a NRZ-L serial data stream, TTL compatible, along with a reconstructed 2 MHz clock from the PCM receiver. The science data will be transmitted in real time via the high speed PCM data link at a rate of 2 Megabits per second. Clock duty cycle shall be 50%. The data will change on the rising edge of the zero degree clock; the experimenter will sample the data line on the falling edge of the clock. The signal levels shall be TTL compatible fed over 50 ohm coax with the experimenter terminating the lines in 50 ohms. The ground station(s) must record data from T-30 seconds to the end.

2. Commands

The experiment require 3 digital commands from the TM/ACS section. These signals shall be open circuit contact closures to experiment signal ground at the time of function activation. Open circuit voltage shall be +5 volts and the switch must sink 5 mA with no more than 0.2 volts drop with respect to experiment signal ground.

2.1 On Target

When the ACS has acquired fine mode on the science target the ACS shall issue an "On Target" signal to the experiment.

2.2 Timer Driven Functions

Two TM generated timer channels control relay switch closures, Timer Cmd A and Timer Cmd B. When the timer event is "On" the switch contact is closed. On and off times are to be determined.

3. Power and Grounding

The experiment shall require a nominal +28 volts. Peak voltage shall not exceed +35 volts at any time. Minimum voltage shall be greater than +21 volts. Power will be 150 watts, average; 200 watts, peak. Experiment power shall be removed prior to chute opening. Primary power return will be isolated from experiment signal ground within the experiment by at least 1 Megohm in parallel with .05 µfd. Both returns are isolated from chassis by at least 1 Megohm in parallel with .05 µfd. Primary return and signal return are connected to chassis within the TM section at a single point.

4. Connectors

The FUSP experiment interface connectors are summarized below.

Experiment Related Connectors

Location	Functions	FUSP (36.173)	Type
TM Section Skin	Experiment Umbilical	J900	DCMA-37S
Experiment Connector Deck	Power/ Telemetry	J980	PT07SE-22-55P
	Analog Telemetry/F.O. Drive	J981	PT07SE-22-55S
	ST2 ZOD RS170 Video	J713	Amphenol 31-4803
	ST2 ZOD ST5000 MkIID Interface	J714	PT07SE-24-61P
	ST1 Aft Looking ST5000 Sensor Cabling	J715	PT07SE-14-18P
	Shutter Door Interface	J756	PT07SE-18-32P

4.1 Experiment - GSE Cabling

Figure 1 shows a block diagram of experiment - GSE connections via umbilical cables.

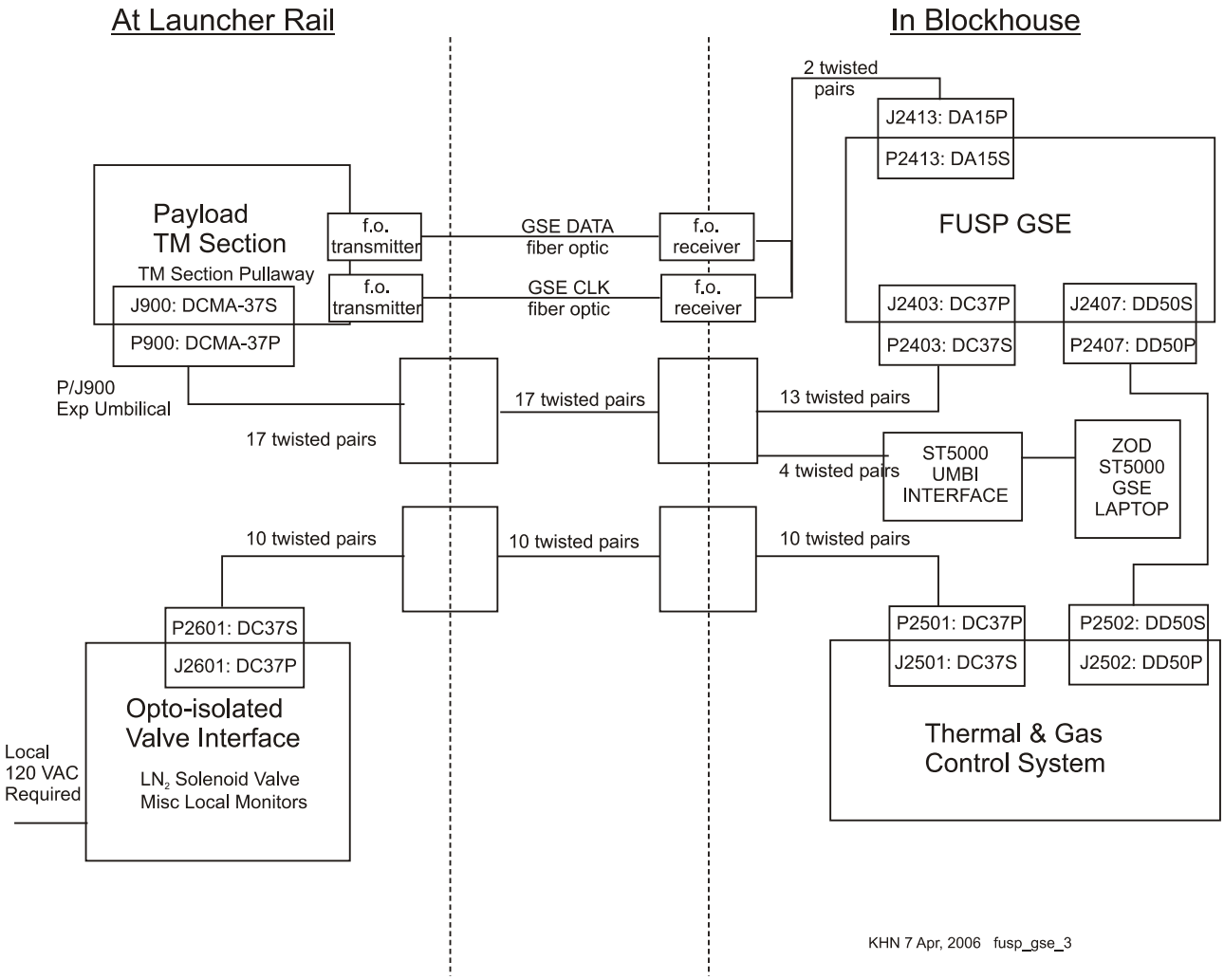

Figure 1. FUSP Rail to Blockhouse Cabling

The experiment umbilical, P/J900, provides for a serial command link between the GSE (within the block house) and the onboard experiment processor (DEP). Full duplex ASCII commands will be transmitted over these lines using an optically isolated current loop. Transmission rate shall be 2400 baud.

Experiment generated 2MHz serial GSE data and clock signals in RS422 format are also present at J900. This allows a direct hardwired link via twisted pair cabling between the experiment and the GSE during integration and other testing situations when an RF link is not available or required and cable lengths are short.

When the payload is on the rail, the serial GSE data and clock signals are sent via a WFF two channel fiber optic transmitter module mounted in the TM section. Fiber pullaways on the TM skin couple to two rail-mounted fiber optic cables which ultimately run to the experiment GSE in the blockhouse. An experimenter supplied fiber optic receiver converts the signals back to the RS422 format for compatibility with the experiment GSE.

The selection between the hardwired link or the fiber optic link is determined by a programming connector in the experiment section, only one of the two links is active depending on the configuration of the programming connector wiring.

Other opto-isolated signals to and from the GSE provide control of experiment functions, the ZOD startracker ST2, and telemetry of detector thermal conditions prior to launch. A total of 17 twisted pairs are required in the experiment umbilical cable, with a one to one correspondence in pin assignments from P/J900 at the payload to P/J2403 at the GSE. Table 1 provides the complete contact assignment for J900.

Table 1 - J900: DCMA-37S Experiment Umbilical on TM Section Skin

Pin	Description	Notes	Destination
J900-1	ST2 ISO+12V	Paired with J900-20	P/J714-A
J900-2	ST2 RD(A)	Paired with J900-21	P/J714-C
J900-3	ST2 TD(A)	Paired with J900-22	P/J714-E
J900-4	ST2 FLT/TSTN-H	Paired with J900-23	P/J714-G
J900-5	DEP Reset Hi	Paired with J900-24	P/J980-J
J900-6	CLK Reset Hi	Paired with J900-25	P/J980-L
J900-7	EEPROM WRT ENA Hi	Paired with J900-26	P/J980-V
J900-8	DEP Serial TXD Hi	Paired with J900-27	P/J980-X
J900-9	DEP Serial RXD Hi	Paired with J900-28	P/J980-Z
J900-10	Serial GSE Data +	Paired with J900-29	P/J980-d
J900-11	Serial GSE Clock +	Paired with J900-30	P/J980-f
J900-12	USE-E-Hi	Paired with J900-31	P/J980-EE
J900-13	Audio Speaker Hi	Paired with J900-32	P/J980-GG
J900-14	USE-A-Hi	Paired with J900-33	P/J980-R
J900-15	USE-B-Hi	Paired with J900-34	P/J980-T
J900-16	USE-C-Hi	Paired with J900-35	P/J980-y
J900-17	USE-D-Hi	Paired with J900-36	P/J980-AA
J900-18	N/A		N/C
J900-19	N/A		N/C
J900-20	ST2 ISO-GND		P/J714-B
J900-21	ST2 RD(B)		P/J714-D
J900-22	ST2 TD(B)		P/J714-F
J900-23	ST2 FLT/TSTN-L		P/J714-H
J900-24	DEP Reset Lo		P/J980-K
J900-25	CLK Reset Lo		P/J980-M
J900-26	EEPROM WRT ENA Lo		P/J980-W
J900-27	DEP Serial TXD Lo		P/J980-Y
J900-28	DEP Serial RXD Lo		P/J980-a
J900-29	Serial GSE Data -		P/J980-e

Pin	Description	Notes	Destination
J900-30	Serial GSE Clock -		P/J980-g
J900-31	USE-E-Lo		P/J980-FF
J900-32	Audio Speaker Lo		P/J980-HH
J900-33	USE-A-Lo		P/J980-S
J900- 34	USE-B-Lo		P/J980-U
J900-35	USE-C-Lo		P/J980-z
J900-36	USE-D-Lo		P/J980-BB
J900-37	N/A		N/C

In addition to a direct umbilical connection to the payload, a second GSE/blockhouse to payload/rail cable system is necessary to monitor and control the flow of liquid nitrogen to the detector cold sink within the payload. This is shown in Figure 1 as the P/J2601 to P/J2501 cable system. 10 twisted pair lines are required. Table 2 provides the complete contact assignments for J2601, the connector on the Valve Interface, which is located on or near the base of the launcher rail.

Table 2 - J2601: DC37P. Thermal Control Valve Interface

Pin	Description	Notes	Destination
J2601-1	Aux Umbi AD590 Hi	Paired with J2601-20	P/J2501-1
J2601-2	Spare Pair#1 Hi	Paired with J2601-21	P/J2501-2
J2601-3	N/A		N/C
J2601-4	Mon-1 Hi	Paired with J2601-23	P/J2501-4
J2601-5	Mon-2 Hi	Paired with J2601-24	P/J2501-5
J2601-6	Mon-3 Hi	Paired with J2601-25	P/J2501-6
J2601-7	Mon-4 Hi	Paired with J2601-26	P/J2501-7
J2601-8	N/A		N/C
J2601-9	N/A		N/C
J2601-10	SSR-1 Drive Hi (coolant)	Paired with J2601-29	P/J2501-10
J2601-11	SSR-2 Drive Hi	Paired with J2601-30	P/J2501-11
J2601-12	SSR-3 Drive Hi	Paired with J2601-31	P/J2501-12
J2601-13	SSR-4 Drive Hi	Paired with J2601-32	P/J2501-13
J2601-14	N/A		N/C
J2601-15	“		“
J2601-16	“		“
J2601-17	“		“
J2601-18	“		“
J2601-19	N/A		N/C
J2601-20	Aux Umbi AD590 Lo		P/J2501-20
J2601-21	Spare Pair#1 Lo		P/J2501-21
J1601-22	N/A		N/C
J2601-23	Mon-1 Lo		P/J2501-23
J2601-24	Mon-2 Lo		P/J2501-24

Pin	Description	Notes	Destination
J2601-25	Mon-3 Lo		P/J2501-25
J2601-26	Mon-4 Lo		P/J2501-26
J2601-27	N/A		N/C
J2601-28	N/A		N/C
J2601-29	SSR-1 Drive Lo (coolant)		P/J2501-29
J2601-30	SSR-2 Drive Lo		P/J2501-30
J2601-31	SSR-3 Drive Lo		P/J2501-31
J2601-32	SSR-4 Drive Lo		P/J2501-32
J2601-33	N/A		N/C
J2601-34	“		“
J2601-35	“		“
J2601-36	“		“
J2601-37	N/A		N/C

4.2 Experiment Power and Telemetry Interface

J980 and J981 are the main interface connectors between the FUSP experiment section and the TM section. These two connectors are located on the experiment connector deck, which is located at the separation plane between the experiment and TM sections.

In addition to experiment power, TM data, monitors and commands; J980 also contains all experiment umbilical wiring which routes directly to J900, the experiment umbilical connector. Table 3 provides the complete contact assignments for J980.

There are a total of 48 analog monitor signals generated by the experiment electronics and routed to the telemetry section. All experiment analog monitors are 0 to +5V single ended signals, and a sampling rate greater than 50 samples per second is sufficient. 11 of the 48 monitors are assigned to connector J980. The remaining 37 monitors are assigned to connector J981. J981 also provides a direct routing of the RS422 GSE data and clock signals which drive the WFF fiber optic transmitter module. Power for the transmitter module is also supplied from the experiment DC supply section via J981. Table 4 provides the complete contact assignments for J981.

Table 3 - J980: PT07SE-22-55P

Pin	Description	Notes	Destination
J980-A	Exp + 28V	Experiment power from TM	TM
J980-B	“	“	“
J980-C	“	“	“
J980-D	Exp + 28V	Experiment power from TM	“
J980-E	Exp + 28V Rtn	Experiment power return	“
J980-F	“	“	“
J980-G	“	“	“
J980-H	Exp + 28V Rtn	Experiment power return	TM
J980-J	DEP Reset Hi	Opto-isolated to GSE via umbi	P/J900-5
J980-K	DEP Reset Lo	“	P/J900-24

Pin	Description	Notes	Destination
J980-L	CLK Reset Hi	“	P/J900-6
J980-M	CLK Reset Lo	Opto-isolated to GSE via umbi	P/J900-25
J980-N	Timer Cmd A Hi	N.O. contact closure when active	TM
J980-P	Timer Cmd A Lo	COM contact for Cmd A Hi	TM
J980-R	USE-A-Hi	Opto-isolated to GSE via umbi	P/J900-14
J980-S	USE-A-Lo	“	P/J900-33
J980-T	USE-B-Hi	“	P/J900-15
J980-U	USE-B-Lo	“	P/J900-34
J980-V	EEPROM WRT ENA Hi	“	P/J900-5
J980-W	EEPROM WRT ENA Lo	“	P/J900-26
J980-X	DEP Serial TXD Hi	“	P/J900-8
J980-Y	DEP Serial TXD Lo	“	P/J900-27
J980-Z	DEP Serial RXD Hi	“	P/J900-9
J980-a	DEP Serial RXD Lo	Opto- isolated to GSE via umbi	P/J900-28
J980-b	Serial TM Data	2Mbit/sec NRZ serial TM data	TM
J980-c	Serial TM Data Rtn	Exp. Signal Return	TM
J980-d	Serial GSE Data +	2Mbit/sec Data RS 422+ via umbi	P/J900-10
J980-e	Serial GSE Data -	2Mbit/sec Data RS 422- via umbi	P/J900-29
J980-f	Serial GSE Clock +	2Mbit/sec Clock RS 422+ via umbi	P/J900-11
J980-g	Serial GSE Clock -	2Mbit/sec Clock RS 422- via umbi	P/J900-30
J980-h	Timer Cmd B Hi	N.O. contact closure when active	TM
J980-i	Timer Cmd B Lo	COM contact for Cmd B Hi	TM
J980-j	On Target Hi	N.O. contact closure when on target	ACS via TM
J980-k	On Target Lo	COM contact for On Target Hi	ACS via TM
J980-m	EXP+28VM-TM	0-5V Analog Monitor	TM
J980-n	EXP-IMON-TM	“	“
J980-p	EXP+5VM-TM	“	“
J980-q	EXP+15VM-TM	“	“
J980-r	EXP-15VM-TM	“	“
J980-s	DET+28VM-TM	“	“
J980-t	DET+7.5VM-TM	“	“
J980-u	DTC+12VM-TM	“	“
J980-v	AUXVM-TM	“	“
J980-w	MECH+28VM-TM	“	“
J980-x	MECH-IMON-TM	0-5V Analog Monitor	TM
J980-y	USE-C-Hi	Opto-isolated to GSE via umbi	P/J900-16
J980-z	USE-C-Lo	“	P/J900-35
J980-AA	USE-D-Hi	“	P/J900-17
J980-BB	USE-D-Lo	Opto-isolated to GSE via umbi	P/J900-36
J980-CC	Analog Monitor Gnd	Exp. Signal Return	TM
J980-DD	Analog Monitor Gnd	Exp. Signal Return	TM
J980-EE	USE-E-Hi	Opto-isolated to GSE via umbi	P/J900-12
J980-FF	USE-E-Lo	Opto-isolated to GSE via umbi	P/J900-31
J980-GG	Audio Speaker Hi	Transformer coupled audio to GSE via umbi	P/J900-13

Pin	Description	Notes	Destination
J980-HH	Audio Speaker Lo	Transformer coupled audio to GSE via umbi	P/J900-32

Table 4 - J981: PT07SE-22-55S

Pin	Description	Notes	Destination
J981-A	DET+5VDM-TM	0-5V Analog Monitor	TM
J981-B	DET+5VAM-TM	“	“
J981-C	DET+/-15VAM-TM	“	“
J981-D	CCD Temp	“	“
J981-E	TEC Hot-Side Temp	“	“
J981-F	Cold Sink Temp	“	“
J981-G	TEC Voltage	“	“
J981-H	TEC Current	“	“
J981-J	Heater Current	0-5V Analog Monitor	TM
J981-K	N/A		N/C
J981-L	“		“
J981-M	“		“
J981-N	“		“
J981-P	“		“
J981-R	“		“
J981-S	“		“
J981-T	“		“
J981-U	N/A		N/C
J981-V	DTC Command	0-5V Analog Monitor	TM
J981-W	DTC Drive	“	“
J981-X	Cal Lamp Voltage	“	“
J981-Y	Cal Lamp Current	“	“
J981-Z	Humidity Opt-Sect	“	“
J981-a	Humidity Elect-Sect	“	“
J981-b	Pressure Opt-Sect	“	“
J981-c	Pressure Elect-Sect	“	“
J981-d	Vacuum Gauge Opt-Sect	“	“
J981-e	Vacum Gauge Fault	“	“
J981-f	Audio Level	0-5V Analog Monitor	TM
J981-g	Fiber GSE Data+	2Mbit/sec Data RS422+	TM FO Module
J981-h	Fiber GSE Data-	2Mbit/sec Data RS422-	TM FO Module
J981-i	Fiber GSE Clock+	2Mbit/sec Clock RS422+	TM FO Module
J981-j	Fiber GSE Clock-	2Mbit/sec Clock RS422-	TM FO Module
J981-k	Fiber Trans +5V	Exp +5V	TM FO Module
J981-m	FiberTrans 5V Rtn	Exp 5V Rtn	TM FO Module
J981-n	N/A		N/C
J981-p	Temp 1: Vac Bulkhead	0-5V Analog Monitor	TM
J981-q	Temp 2: Waveplate Motor	“	“

Pin	Description	Notes	Destination
J981-r	Temp 3: Spectrometer	“	“
J981-s	Temp 4: Opt-Skin	“	“
J981-t	Temp 5: DTC Electronics	“	“
J981-u	Temp 6: Cal Lamp	“	“
J981-v	Temp 7: Elect -Deck	“	“
J981-w	Temp 8: EXP + 5V DC-DC	“	“
J981-x	Temp 9: ST2 Base	“	“
J981-y	Temp 10: ST3 Base	“	“
J981-z	Temp 11: DEP Crate	“	“
J981-AA	Temp 12: Coolant Port	“	“
J981-BB	Waveplate - Rotation	“	“
J981-CC	Waveplate - Index	“	“
J981-DD	Waveplate - Limit	“	“
J981-EE	Waveplate - Force	“	“
J981-FF	Waveplate - Ref	0-5V Analog Monitor	“
J981-GG	Analog Monitor Gnd	Exp. Signal Return	“
J981-HH	Analog Monitor Gnd	Exp. Signal Return	TM

4.3 Star Tracker Interface

Interface for the two startrackers, ST1 (Aft Looking ST5000 MkIID) and ST2 (ZOD ST5000 MkIID), will be via three connectors, J713, J714, and J715, mounted on the experiment connector deck. Tables 5.1 - 5.3 provide the complete contact assignments for these connectors.

Table 5.1 - J713: Amphenol 31-4803. ST2 ZOD RS170 Video

BNC isolated bulkhead adapter

Jack-Jack

Pin	Description:	Notes	Destination
J713 - inner	ST2 ZOD RS170-SIG	Video signal for downlink	TM
J713 - outer	ST2 ZOD RS170-GND	Coax shield	TM

Table 5.2 - J714: PT07SE-24-61P. ST2 ZOD ST5000 MkIID Interface

Pin	Description:	Notes	Destination
J714-A	ISO+12V		J900-1
J714-B	ISO-GND		J900-20
J714-C	RD(A)		J900-2
J714-D	RD(B)		J900-21
J714-E	TD(A)		J900-3
J714-F	TD(B)		J900-22
J714-G	FLT/TSTN-H		J900-4
J714-H	FLT/TSTN-L		J900-23
J714-J	N/A		N/C
J714-K	N/A		N/C

Pin	Description:	Notes	Destination
J714-L	N/A		N/C
J714-M	“		“
J714-N	“		“
J714-P	“		“
J714-R	“		“
J714-S	“		“
J714-T	“		“
J714-U	“		“
J714-V	“		“
J714-W	“		“
J714-X	“		“
J714-Y	“		“
J714-Z	N/A		N/C
J714-a	+28V(A)		TM
J714-b	28V-RET(A)		“
J714-c	+28V(B)		“
J714-d	28V-RET(B)		“
J714-e	CMD0		“
J714-f	SIG-GND1		“
J714-g	CMD1		“
J714-h	SIG-GND2		“
J714-i	CMD2		“
J714-j	CMD3		“
J714-k	SIG-GND3		“
J714-m	CMD4		“
J714-n	CMD5		“
J714-p	CMD6		TM
J714-q	N/A		N/C
J714-r	“		“
J714-s	“		“
J714-t	“		“
J714-u	N/A		N/C
J714-v	DOB4-MON		TM
J714-w	DOB5-MON		“
J714-x	DOB6-MON		“
J714-y	DOB7-MON		“
J714-z	PITCH-ERR-MON		“
J714-AA	YAW-ERR-MON		“
J714-BB	ROLL-ERR-MON		“
J714-CC	STAR-MAG-MON		TM
J714-DD	N/A		N/C
J714-EE	“		“
j714-FF	“		“
J714-GG	N/A		N/C

Pin	Description:	Notes	Destination
J714-HH	N/A		N/C
J714-JJ	BUS-V-MON		TM
J714-KK	BUS-I-MON		“
J714-LL	SIG-GND4		“
J714-MM	COM1-TM-422-TX+		“
J714-NN	COM1-TM-422-TX-		“
J714-PP	COM1-TM-422-GND		TM

Table 5.3 - J715: PT07SE-14-18P. ST1 Aft Looking ST5000 Sensor

Pin	Description:	Notes	Destination
J715-A	CAM PWR +12V		ACS
J715-B	PWR RTN		“
J715-C	TS1+		“
J715-D	TS1-		“
J715-E	TS2+		“
J715-F	TS2-		“
J715-G	INTEGRATE		“
J715-H	SB1N		“
J715-J	GAIN UP/DWN		“
J715-K	SB2N		“
J715-L	GAIN CLK		“
J715-M	VIDEO-SIG		“
J715-N	VIDEO-SHLD		“
J715-P	SB3N		“
J715-R	PIX-CLK-SIG		“
J715-S	PIX-CLK-SHLD		“
J715-T	CAM-AUX-1N		“
J715-U	CMD +5V		ACS

4.4 Shutter Door/Ignition Interface

Interface from the TM section to the aft-looking shutter door and ignitor housing interface is via connector J756: PT07SE-18-32P, mounted on the experiment connector deck. There is a one to one correspondence in pin assignments from J756 to P/J750, the main vacuum door connector pair which is located in the experiment optical section at the vacuum door lid. All 32 contacts at J756 will be wired through to P750, to allow for possible future usage of currently unassigned contacts. Table 6 provides the complete contact assignment for J756.

Table 6 - J756: PT07SE-18-32P Door & Ignitor

Pin:	Description:	Notes	Destination
J756-A	Spare		N/C
J756-B	Spare		“
J756-C	Spare		“

Pin:	Description:	Notes	Destination
J756-D	Spare		“
J756-E	Spare		“
J756-F	Spare		N/C
J756-G	Door Open		TM
J756-H	Door Open		“
J756-J	Door Close		“
J756-K	Door Close		“
J756-L	PWR GND		“
J756-M	PWR GND		“
J756-N	Closing/Opening Mon		“
J756-P	+5V Input		“
J756-R	Position Monitor		“
J756-S	SIG GND		“
J756-T	Spare		“
J756-U	TTS SIG Gnd A		“
J756-V	TTS AGC TM Mon		TM
J756-W	Spare		N/C
J756-X	Spare		N/C
J756-Y	ACS Start Loop		TM
J756-Z	ACS Start Loop		“
J756-a	SYS #1 SCM Mon		“
J756-b	SCM DATA Gnd		“
J756-c	+5V Input		“
J756-d	Motor Pressure		“
J756-e	SEP Loop		“
J756-f	SEP Loop		“
J756-g	SYS #2 SCM Mon		“
J756-h	ACS Start Loop		“
J756-j	ACS Start Loop		TM