INGRID ARRAY and CONTROLLER WIRING

The electrical connections required to operate the HAWAII array inside the INGRID cryostat using a SDSU controller are described in this note. The grounding and earth configurations are also described.

The connection system uses a star point configuration for grounding purposes, as far as practically possible, to reduce the problems associated with ground loops. This star point is in the SDSU controller itself. Most of the signal lines are shielded but with the shield only connected to the ground at one end only. Again this ensures no ground loops are formed. This configuration acts best to reduce low frequency pickup – mainly 50 Hz hum and its associated harmonics. It works less well for high frequencies where shielding ought to be connected at both ends.

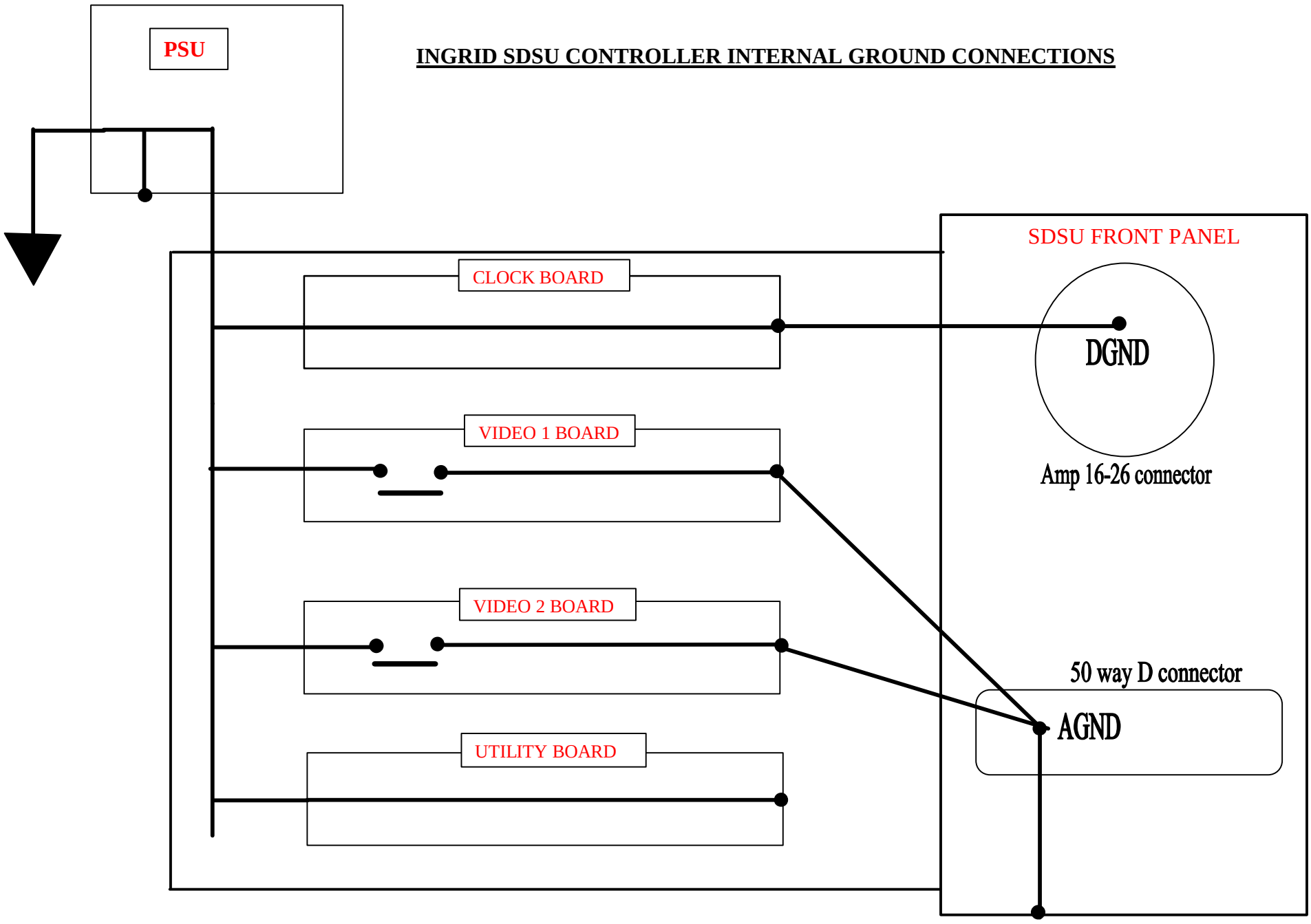
This note shows the earthing and grounding configuration in a few very level diagrams. These diagrams should be used in conjunction with the tables which give all the details to the cabling.

This note only describes those cables associated with driving the HAWAII array. It does not give the details required to operate the moving mechanisms etc.

The connections and configurations can be broken down to the following sub sections.

?? SDSU Controller internal and front panel connections
?? SDSU Controller front panel to INGRID Preamp Box connections
?? SDSU Controller clock cable connections
?? INGRID to HAWAII fanout board connections.
?? INGRID safety earth connections.

INGRID SDSU CONTROLLER INTERNAL GROUND CONNECTIONS



SDSU FRONT PANEL INTERNAL CONNECTIONS

(connections from front panel connectors to boards in controller)

SIGNAL NAME	FRONT PANEL 50 way D	FRONT PANEL 26 Way		VP1 BOARD 9 way D	VP1 BOARD 15 way D	VP2 BOARD 9 way D	VP2 BOARD 15 way D	CLK BOARD 37 way D	WIRE TYPE
OUT1	2			4					COAX
OUT1 SHIELD	N/C			5					COAX SHIELD
OUT2	3			2					COAX
OUT2 SHIELD	N/C			7					COAX SHIELD
OUT3	4					4			COAX
OUT3 SHIELD	N/C					5			COAX SHIELD
OUT4	5					2			COAX
OUT4 SHIELD	N/C					7			COAX SHIELD
AGND	19				8				22AWG
AGND	20			8					22AWG
AGND	21						8		22AWG
AGND	22,35					8			22AWG
AGND	35	FLYING		LEAD	connected	to	CHASSIS	only	22AWG
+15V	1				9				22AWG
BIASGATE	50				4				26AWG
HIGH3	7						1		26AWG
OFFSET1	18				1				26AWG
HIGH2	23				6				26AWG
HIGH4	24						2		26AWG
-15V	34				10				22AWG
OFFSET2	36						3		26AWG
OFFSET3	37						4		26AWG
OFFSET4	38						5		26AWG
HIGH1	39				3				26AWG
BIASPWR	17						6		26AWG
VRESET	41				2				26AWG
VDD		A			5				22AWG
DGND		b						22	22AWG
FSYNC2		D						10	26AWG
LINE3		T						14	26AWG
LINE1		C						2	26AWG
READ2		F						12	26AWG
RESET3		X						13	26AWG
LSYNC4		Z						34	26AWG
LSYNC2		L						9	26AWG
PIXEL4		a						36	26AWG
FSYNC4		c						35	26AWG
FSYNC1		E						4	26AWG
LINE2		B						8	26AWG
READ3		H						18	26AWG

RESET4		**Y**						**19**	**26AWG**
RESET2		**J**						**7**	**26AWG**
LSYNC3		**N**						**15**	**26AWG**
PIXEL3		**S**						**17**	**26AWG**
FSYNC3		**V**						**16**	**26AWG**
LINE4		**U**						**33**	**26AWG**
READ4		**W**						**37**	**26AWG**
READ1		**G**						**6**	**26AWG**
RESET1		**K**						**1**	**26AWG**
LSYNC1		**M**						**3**	**26AWG**
PIXEL2		**P**						**11**	**26AWG**
PIXEL1		**R**						**5**	**26AWG**

Notes

?? Coax cables only connected at one end as specified.
?? Use thicker cable when specified.
?? Connect CHASSIS to GND as specified.
?? All 9,15 and 37 way D types are female plugs.

Assignments for the bias voltages to the DAC channels are shown below.

VP1 BOARD DAC CHANNELS - P2

VOLTAGE	DAC	Pin
BIAS A	DAC1,1	
BIAS B	DAC1,2	
OFFSET4	DAC1,3	1
VRESET	DAC1,4	2
HIGH1	DAC2,1	3
BIASGATE	DAC2,2	4
VDD	DAC2,3	5
HIGH2	DAC2,4	6

VP2 BOARD DAC CHANNELS - P2

VOLTAGE	DAC	Pin
BIAS A	DAC1,1	
BIASB	DAC1,2	
HIGH3	DAC1,3	1
HIGH4	DAC1,4	2
OFFSET3	DAC2,1	3
OFFSET2	DAC2,2	4
OFFSET1	DAC2,3	5
BIAS PWR	DAC2,4	6

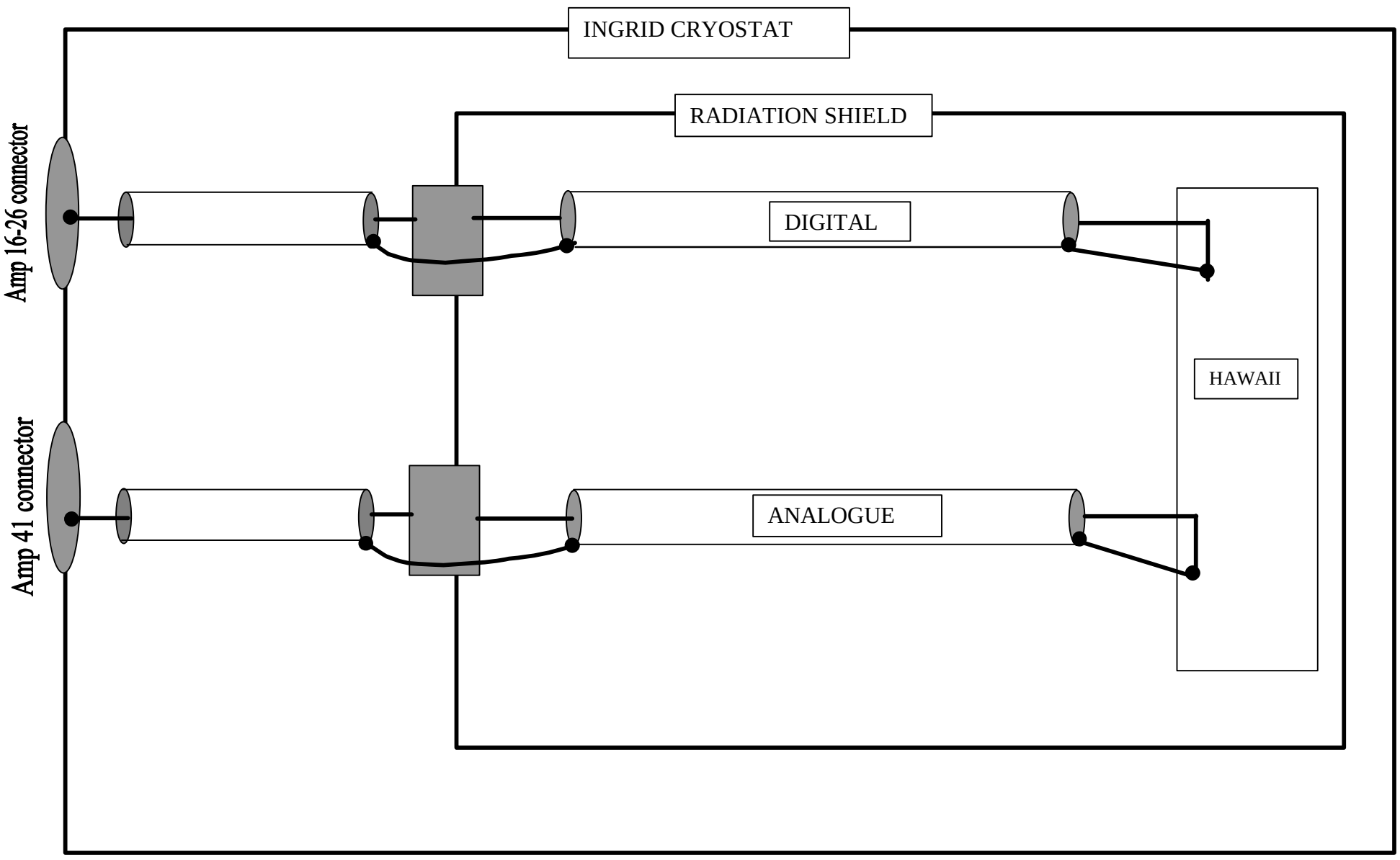
Cable from SDSU Controller to Preamp Box

50 way MALE PLUG	SIGNAL NAME	CABLE TYPE	50 way FEMALE PLUG
1	+15V supply	22AWG	1
34	-15V supply	22AWG	34
19	ANALOG GND	22AWG	19
39	HIGH1	26AWG	39
23	HIGH2	26AWG	23
7	HIGH3	26AWG	7
24	HIGH4	26AWG	24
41	VRESET	26AWG	41
18	OFFSET1	26AWG	18
36	OFFSET2	26AWG	36
37	OFFSET3	26AWG	37
38	OFFSET4	26AWG	38
50	BIASGATE	26AWG	50
17	BIASPOWER	26AWG	17
22	BIAS SHIELD	COAX SHIELDING	ONE SHIELD OVER ALL THE ABOVE ONLY CONNECT MALE END
2	OUT1	COAX	2
21	OUT1 SHIELD		ONLY CONNECT AT MALE END
3	OUT2	COAX	3
21	OUT2 SHIELD		ONLY CONNECT AT MALE END
4	OUT3	COAX.	4
21	OUT3 SHIELD		ONLY CONNECT AT MALE END
5	OUT4	COAX	5
21	OUT4 SHIELD		ONLY CONNECT AT MALE END
20	OVERALL SHIELD	COAX SHIELDING	ONE SHIELD OVER ALL CABLES - ONLY CONNECT MALE END

Clock cable connection between two AMP16-26 connectors

Signal Name	Amphenol 16-26 free plug		Amphenol 16-26 free socket	Comments
VDD	A		A	22AWG
DGND	b		b	22AWG
VDD SHIELD	b		n/c	
PIXEL1	R		R	26AWG
LSYNC1	M		M	26AWG
FSYNC1	E		E	26AWG
READ1	G		G	26AWG
RESET1	K		K	26AWG
LINE1	C		C	26AWG
CLOCK SHIELD1	b		n/c	
PIXEL2	P		P	26AWG
LSYNC2	L		L	26AWG
FSYNC2	D		D	26AWG
READ2	F		F	26AWG
RESET2	J		J	26AWG
LINE2	B		B	26AWG
CLOCK SHIELD2	b		n/c	
PIXEL3	S		S	26AWG
LSYNC3	N		N	26AWG
FSYNC3	V		V	26AWG
READ3	H		H	26AWG
RESET3	X		X	26AWG
LINE3	T		T	26AWG
CLOCK SHIELD3	b		n/c	
PIXEL4	a		a	26AWG
LSYNC4	Z		Z	26AWG
FSYNC4	c		c	26AWG
READ4	W		W	26AWG
RESET4	Y		Y	26AWG
LINE4	U		U	26AWG
CLOCK SHIELD4	b		n/c	

INGRID CRYOSTAT INTERNAL CONNECTIONS



AMPHENOL 16-26 -> FANOUT BOARD J2 (MDM37) CONNECTOR

Signal Name	MDM-37 (J2)	Amphenol 16-26	Comments
VDD	21	A	copper
DGND	19	b	copper
DGND	20	b	copper
VDD SHIELD	22	n/c	shield these wires
PIXEL1	18	R	manganin
LSYNC1	13	M	manganin
FSYNC1	36	E	manganin
READ1	31	G	manganin
RESET1	26	K	manganin
LINE1	8	C	manganin
CLOCK SHIELD1	14	n/c	shields these wires
PIXEL2	17	P	manganin
LSYNC2	12	L	manganin
FSYNC2	35	D	manganin
READ2	30	F	manganin
RESET2	25	J	manganin
LINE2	7	B	manganin
CLOCK SHIELD2	9	n/c	shields these wires
PIXEL3	16	S	manganin
LSYNC3	11	N	manganin
FSYNC3	34	V	manganin
READ3	29	H	manganin
RESET3	24	X	manganin
LINE3	6	T	manganin
CLOCK SHIELD3	4	n/c	shields these wires
PIXEL4	15	a	manganin
LSYNC4	10	Z	manganin
FSYNC4	33	c	manganin
READ4	28	W	manganin
RESET4	23	Y	manganin
LINE4	5	U	manganin
CLOCK SHIELD4	32	n/c	shields these wires

FANOUT BOARD J1 -> HERMETIC CONNECTOR

Signal Name	MDM-31 (J1)	Amphenol 20-41	Comments
OUT1+	13	S	twist with OUT1-
OUT1-	29	R	twist with OUT1+
OUT1 SHIELD	12	n/c	shield OUT1
OUT2+	11	P	twist with OUT2-
OUT2-	27	g	twist with OUT2+
OUT2 SHIELD	10	n/c	shield OUT2
OUT3+	9	N	twist with OUT3-
OUT3-	25	f	twist with OUT3+
OUT3 SHIELD	8	n/c	shield OUT3
OUT4+	7	M	twist with OUT4-
OUT4-	23	e	twist with OUT4+
OUT4 SHIELD	6	n/c	shield OUT4
HIGH1	16	r	manganin
HIGH2	15	h	manganin
HIGH3	18	T	manganin
HIGH4	17	L	manganin
BIASGATE	4	U	manganin
BIASPOWER	3	j	manganin
VRESET	2	q	manganin
AGND	30	d	copper
AGND	29	d	connected together
AGND	26	d	connected together
AGND	24	d	connected together
AGND	22	n/c	
AGND	14	n/c	
AGND	5	n/c	
BIAS SHIELD	31	n/c	shield these wires
TGND	20	n/c	not used

Notes

?? Each of the four outputs from the HAWAII device is a shielded twisted pair. Copper wire (PTFE coated) should be used for the lines and the miniature co -ax cable shie ld wire should be stripped and used to screen the twisted pairs. The screen should only be connected at one end as specified.

?? Copper wire should be used for the AGND connections. These wires are paralleled up as specified.

?? An outer shield should be conne cted over the Bias lines as specified. This should only be connected at one end.

?? Use manganin where specified.

?? Each sub set of clock lines is to be shielded. The technician will need to strip co -ax shield cable from the miniature co -ax cable supplied an d use this to shield the clock groups as specified. The shield must only be connected to the fanout board end. It must NOT be connected to the hermetic connector end.

?? All cables should be made as short as practically possible.

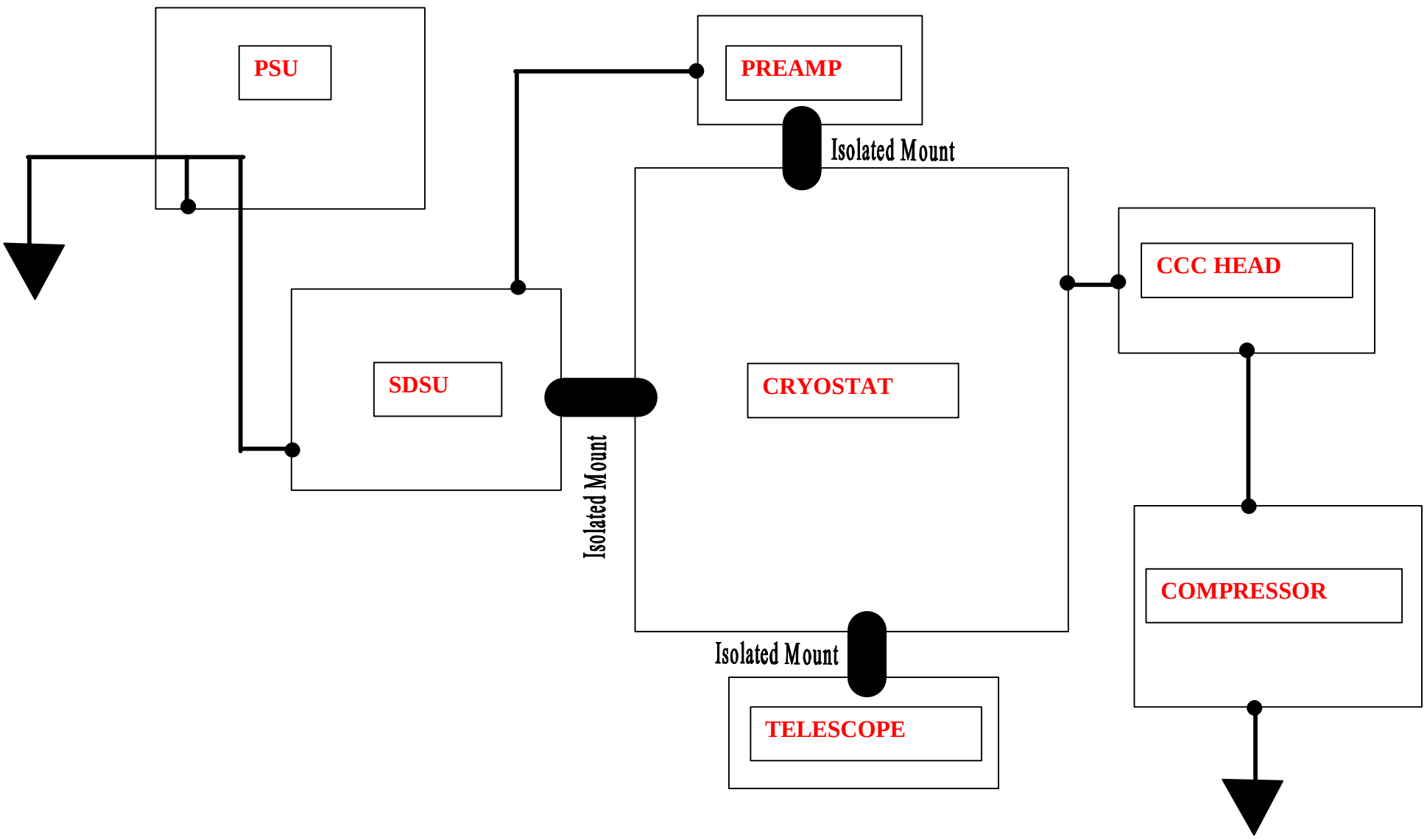
?? These cables may have to go via a connector block on the radiation shield. If so then all connections should be straight through including the shields which must go via pins in the connectors and not via the connector shells. This means that the connectors on the radiation shield ma y be of a different size and format than the connectors at either end of the cable.

?? Connections are also required to be made to the J3 MDM9 way connecotr on the fanout board. This connector allows control of a preflash LED on the board an temperature checking of the board. The board connections are as shown below. These wires must go to another hermetic 16-26 Amphenol on the cryostat body. This connector's connections will be shared with other temperature sensors' wires ans micro-switches.

DIODE TEMPERATURE SENSE/PREFLASH - J3 –SOCKET PCB MOUNTED 90 DEGREES MALE SOCKET MDM-9PCBR

PIN	SIGNAL
1	TEMP DIODE+
2	TEMP DIODE-
3	PREFLASH LED+
4	PEFLASH LED-

INGRID SAFETY EARTH CONNECTIONS



INGRID GROUNDING PLANS

?? SEPARATE AGND and DGND supplied from the SDSU Controller.
These come to the “star” point in the controller but are supplied separately to the HAWAII device fanout board. This is done to reduce clock feedthrough onto the analog side electronics.

?? The clocks and biases/outputs are supplied on separate cables to the HAWAII device. Each set of signals is shielded with one end of the shield connected to a ground connection at the fanout board end but disconnected at the other end. The shield connection is taken through separate pins on the connectors in the radiation shield.

?? The cryostat body should be isolated from the telescope structure. The preamp box and SDSU controller are mounted off the cryostat using electrically insulated supports. The cryostat does not get its safety earth connection through this path but via the Closed Cycle Cooler Head. **If the CCC is not used and disconnected then a safety earth connection must be made direct to the cryostat body**.

?? The cables for the motors should be wired up as per Berger Lahr instructions. This means that the cables ought to be shielded with the shield only being connected at the drive end. internal cryostat shielding will not be required.