Title: Telescope Cabling for the WIYN 3.5 Meter Telescope

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.1 Remove drive amplifiers and power supplies from near motor locations to location B.
Updated tables of connectors to reflect cable descriptions suggested by UW.
Change cable connector back shells of connectors in the dome to be water tight.
Add dome motor brake control cables.

Revision 6: Date: 9/23/1992

.1 Add OSS cables, TF, TR, OMC1-2, OCB1-2, TLC, and SLC, to the cable list.

Telescope Cabling

Telescope Cabling

1. Cabling Definition

This document defines the cabling between the telescope, dome, and control system components. The cable drapes across the NIR bearings, the cable wrap across the elevation bearing, and cable maypole in the center of the telescope cone are shown in drawings 1.1, 1.2 and 1.3, with the telescope being viewed from the rear. The large cables are the red and blue MOS fiber bundles and coolant lines for the primary mirror cell.

The AC power distribution system includes four power sources; UPS-1, UPS-2, main axis drive battery power and mountain power. UPS-1 is a 12.5 KVA Best Ferrups uninterruptible power supply providing clean power for computers, control and data reduction functions. UPS-2 is a 12.5 KVA Best Ferrups uninterruptible power supply providing power to the Hydra drive motors, power supplies, amplifiers, test instruments used in controlling the telescope, and for less critical control needs. The main axis drive power supply are batteries with chargers supplying a 48 VDC rail voltage to the Azimuth, Elevation and NIR motor amplifiers. Mountain power is used for lighting and general use where if power was interrupted it wouldn't destroy equipment or data.

Location A is the area south of the pier on the ground floor. SI electronics and IAS control electronics maybe located at location A. Location B is the area north-northeast of the pier on the second floor. Major control system components are located at location B.

2. Dome Drive

The seven vent covers and two shutters for the observing slit opening are powered through dome slip rings. These systems are independent of all control system functions. The shutter motion is controlled by a Toshiba EX40PLUS programmable logic controller and two VT130G2U2025 variable frequency drives. The vent covers are controlled by standard garage door openers.

The dome motion control consists of two Toshiba variable frequency drives, VT130G2U2080 with Multioption Board (RS485) VF3X-0983, driving 7.5 horsepower AC induction Eurodrive gear motors. Communication with the TCS is through an RS485 link provided by the multioption board. Manual control of the dome rotation will be possible. A fail-safe brake mounted near each drive wheel is activated when power fails or, during shutdown under normal operation. The engagement of both brakes are controlled by a single electrically actuated solenoid and pressure switch that controls air release. The multiturn encoder is a BEI part number MT40D-X-LSS512N-128T-XD17-CR-E-C14-T-5.

Table 2 and figure 2 define the major dome cables used in control of the dome azimuth drives.

	description	function	dia	connector, from	route description	connector, to	AWG
DE	18 cond,+5,gnd, shld	absolute encoder cable	0.38	MS3126J-14-19S	encoder - loc B	MS3126F-14-19P	24
DBS	4 cond shld	brake solenoid control	0.36	MS3126J-10-6S	air to both brakes	MS3126F-10-6P	24
DMC1-2	18 cond, 9 stwpr	monitor Inverter, control	0.38	terminal block	inverter- loc B	MS3126F-14-19P	24
DC1-2	8 cond, shld	RS232 communication	0.23	9 pin D male	inverter - IO	25 pin D male	22
DM1-2	4 cond w/neu,gnd,shld	Inverter to motor	0.75	wired directly to disconnect.			10
DMB1-2	4 cond w/neu,gnd,shld	motor brake cable	0.50	lugs on rectifier	motor - loc B	AAP1452G3	16

Table 2

Cable DE: The cable connector for the BEI encoder, MS3126J-14-19S, is connected to the absolute, multiturn encoder at its location on the North side of the observing floor along the dome drive surface. The cable is routed from the absolute encoder location and connected to the interface chassis directly below at location B with a MS3126F-14-19P connector. Table 2.1 defines the pin assignments for the DE cable listed above.

from	abs encoder conn		length= ~15'
DE	to	interface chassis conn	
socket	plug	grouping	description/comments
A	A		TXD+
B	B		TXD-
C	C		spare
D	D		spare
E	E		spare
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare
L	L		spare
M	M		2400 select
N	N		4800 select
P	P		9600 select
R	R		19200 select
S	S		chassis ground
T	T		circuit ground
U	U		rotation control
V	V		+5 volts DC

Table 2.1

Cable DBS: The MS3126J-10-6S connector is connected to the brake solenoid and pressure switch at their location on the North side of the second floor at location B. The MS3126F-10-6P cable connector and cable is routed from the brake solenoid and pressure switch to the interface chassis at location B. Table 2.2 identifies pin assignments for the dome brake solenoid cable.

from	brake solenoid		length= 1@~15'
DBS	to	interface chassis	
socket	plug	grouping	description/comments
A	A		Dome brake cntrl
B	B		Dome cntrl return
C	C		Dome pressure switch
D	D		Dome switch return
E	E		spare
F	F		spare

Table 2.2

Cable DMC1-2: The cable is connected to the inverter's terminal block at its location on the North side of the 2nd floor. The cable is routed from the inverter location and connected to the CS interface chassis at location B with a MS3126F-14-19P connector. Table 2.3 defines the pin assignments for the two dome motor control cable.

from	inverter term blk		length= ~10'
DMC1-2	to	CS interface chassis conn	
socket	plug	grouping	description/comments
A	A	PLA	fault signal input
B	B	PLB	fault signal output
C	C	PLC	fault signal return
D	D	FM	frequency signal output
E	E	AM	current signal output
F	F	CC	monitor returns
G	G	P24	+24vdc frtn output
H	H	LOW/LL	multi-function signal output
J	J	RCH/UL	multi-function signal output
K	K	RST	reset
L	L	F	forward drive
M	M	R	reverse drive
N	N	ST	drive interlock
P	P	CC	returns
R	R	SS1	multi-function signal inputs
S	S	JOG/SS2	multi-function signal inputs
T	T	AD2/SS3	multi-function signal inputs
U	U	GND(E)	
V	V	GND(E)	

Table 2.3

Cable DC1-2: Two cables connect the two Toshiba, Tosvert VT130G2U2080 inverters to the computer's serial ports. The 9 pin D connectors are connected to the two inverters serial communications port at their locations on the North side of the 2nd floor along the wall. The 25 pin D connectors connect the inverters to the TCS serial ports. Table 2.4 defines the pin assignments for the two dome communication cables.

from	VT130-G2 inverter	length= 2@~10'	
DC1-2	to	TCS RS232 serial ports	
plug	plug	grouping	description/comments
	1		shield - PG
2	2		RXD - TXD
3	3		TXD - RXD
5	4		CTS - RTS
4	5		RTS - CTS
9	6		DTR - DSR
6	20		DSR - DTR
8	8		DCD - DCD
7	7		SG - SG

Table 2.4

3. Telescope Azimuth Axis

The azimuth axis is driven by two Inland Motor QT7801F torque motors with position feedback coming from two Heidenhain ROD800 incremental encoders. There is a Sony B3 Magnesensor with two target magnets on the drive disk used for an accurate home position. Limit switches are located on the telescope cone indicating course center of rotation position and hard and soft rotation limits. The hard limits initiate an emergency stop. If an overspeed condition is sensed by the independent tachometer, an emergency stop is initiated.

Copley model 220 amplifiers, power and control reside at location B. The motors are located on top of the pier along with conditioning electronics for the Sony sensor and Heidenhain encoders. Control is provided by the DCC residing on the TCS backplane. Fail-safe disk brakes, held off with high pressure air, stop azimuth and elevation rotation in case of an emergency. If an emergency condition is detected, a solenoid valve is de-energized which dumps the air pressure allowing both elevation and azimuth brakes to engage. Location of the solenoid release valve and pressure switch will be in the pier next to the high pressure air supply.

Table 3 and the accompanying figure 3 define the major cables. Table 3 describes cable connections around the azimuth disk area and cables connecting top of pier electronics to the CS interface chassis at location B.

	description	function	dia	connector, from	route description	connector, to	AWG
AMD1	2 cond	motor1 drive cable	0.58	APP1452G3	mtr - loc B drv	APP1453G3	10
AMD2	2 cond	motor2 drive cable	0.58	APP1452G3	combined AMD1-2	part of AMD1	
	6 stwpr (by vendor)	encoder signal, +5	-	molded	enc - el, pier top	22856103	
AE1-2	6 stwpr (purchase)	EXE650	-	22856114 Conni	el - loc B intrf	MS3126F-12-10P	
AL	10 cond, 5 stwpr	limit switch	0..35	MS3126F-14-19S	cone - loc B intrf	MS3126F-14-19P	24
AI	6 cond, shld	index Magnesensor	0.23	MS3126F-12-10S	Az dsk - loc B intrf	MS3126F-12-10P	24
AT	6 cond, 3 stwpr	tachometer signal	0.28	MS3126F-12-10S	Az dsk - loc B intrf	MS3126F-12-10P	24
A-EBS	6 cond, 3 stwpr	brake solenoid control(2)	0.28	MS3126F-12-10S	pier - loc B intrf	MS3126F-12-10P	24
AP1-etc	10 cond, shld	DCpwr, +15v, +5v, +12v	0.72		various, as needed		16

Table 3

Cable AMD1-2: The two AAP1452G3 4 conductor connectors are connected to the drive motors at their locations and routed to the J-box on the top of the pier. The cables are routed from the J-box in conduit to a wiregutter at location B where they are combined into a single cable terminated with an AAP1453G3 connector and connected to the CS drive power box. Table 3.1 defines the pin assignments for two azimuth motor drive cables and the connector at location B.

CS conn	from	Ax mtr1 & 2	length= 2@~35'	
AAP1453	AMD1-2	to	drive power box, loc B	
G3--pin	socket	terminal	grouping	description/comments
A	A	A	motor 1	1 out +
B	B	B	motor 1	1 out -
C	A	A	motor 2	2 out +
D	B	B	motor 2	2 out -
E	spare	spare		spare
F	spare	spare		spare

Table 3.1

Cable AE1-2: The cables from the two Heidenhain ROD 800 incremental encoders driven by the azimuth disk are connected to EXE 650 interpolating electronics located next to them on the pier with integral 1 meter cables. A purchased 13 meter cable, with our MS3126F-12-10P connector installed, is connected to the CS interface chassis at location B. Table 3.2 describes the signal and pin assignments for the two azimuth encoder cables.

from	ROD800 inc encoder		length= 2@~1m, 2@~13m	to
AE1-2	to	EXE650 electronics, purchased cable		CS loc B
socket	plug	grouping	description/comments	plug
1	1	green	+signal le1	A
2	2	yellow	-signal le1	B
3	3	brown	+5vdc	C
4	4	white	0vdc	D
5	5	blue	+signal le2	E
6	6	red	-signal le2	F
7	7	grey	+signal le0	G
8	8	pink	-signal le0	H
9	9		shield	J
				K

Table 3.2

Cable AL: The MS3126F-14-19S connector is connected to the limit switches at their locations near the lower azimuth bearing. The cables are routed from the bearing location and connected with a MS3126F-14-19P connector to the CS interface chassis at location B. Table 3.3 defines the pin assignments for the azimuth limit switch cable.

from	limit sw's on cone		length= ~35'
AL	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		CW rotation soft limit
B	B		CW rtn
C	C		CCW rotation soft limit
D	D		CCW rtn
E	E		CW rotation hard limit
F	F		CW rtn
G	G		CCW rotation hard limit
H	H		CCW rtn
J	J		center position switch
K	K		center rtn
L	L		spare
M	M		spare
N	N		spare
P	P		spare
R	R		spare
S	S		spare
T	T		spare
U	U		spare
V	V		spare

Table 3.3

Cable AI: The cable coming from the Sony B3 Magnesensor is connected to detector electronics, PD10, in a Buddy box on top of the pier. A MS3126F-12-10P connector on the box connects to a mating cable connector, MS3126F-12-10S, and routed through the maypole and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 3.4 defines the pin assignments for the azimuth index Magnesensor cable.

from	index sensor	length= ~35'	
AI	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		A+ output 1,2
B	B		A- output 1,2
C	C		+12 vdc
D	D		gnd
E	E		gnd
F	F		shield
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 3.4

Cable AT: The cable with a MS3126F-12-10S connector is connected to the tachometer located on top of the pier and is driven by azimuth disk. The cable is routed from the tachometer location and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 3.5 defines the pin assignments for the azimuth tachometer cable.

from	tachometer, Az axis	length= ~35'	
AT	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		Output +
B	B		Output -
C	C		shield
D	D		spare
E	E		spare
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 3.5

Cable A-EBS: The MS3126F-12-10S connector is connected to the brake solenoid and pressure sensor in the pier next to the high pressure air supply which control bleed valves in the high pressure air lines. The cable is routed from the solenoid and sensor to the CS interface chassis and connected with a MS3126F-12-10P connector. An air pressure intensifier mounted in the pier feeds the high pressure air lines through the solenoid valve and pressure sensor and then routed to the two sets of brakes on both the elevation and azimuth axes. Table 3.6 defines the pin assignments for the azimuth and elevation brake solenoid control cable.

from	brake solenoid	length= 1@~35'	
A-EBS	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		Az & El brake cntrl
B	B		Az & El cntrl return
C	C		Az & El pressure switch
D	D		Az & El switch return
E	E		spare
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 3.6

4. Primary Mirror Subsystem

The *Primary Mirror Interface Specification* is currently being written. A memo has been circulated describing the cable runs to the primary mirror cell, including AC power and utilities such as chill water, vacuum, air pressure and N2 gas. The primary mirror cables, AC power circuits, and general purpose cabling for the folded cassegrain and modified cassegrain positions are included on the schematic.

The following table 4 and figure 4 defines the major cables.

	description	function	dia	connector, from	route description	connector, to	AWG
PT	9 cond, 1 stwpr, 7 pwr	RS485 for temp control	0.28	MS3126J-12-10S	PM to loc B,sp cab	MS3126F-12-10P	24
PR	9 cond, 1 stwpr, 7 pwr	RS485 for temp control	0.28	MS3126J-12-10S	Radiator to loc B	MS3126F-12-10P	24
PC	18 cond, 9 stwpr	RS485 PM comm	0.38	MS3126J-14-19S	PM to loc B	MS3126F-14-19P	24
PP	12 cond, shld	DC power for primary	0.75	G6A18-22-SNE	PM to loc B	G6A18-22-PNE	16

Table 4

Cable PT: The MS3126J-12-10S connector is connected to the primary mirror cell interface box. The cables come across the elevation wrap, through the maypole, and through the cable tray to location B. Connection is made with a MS3126F-12-10P connector to the primary mirror power supply. Table 4.1 defines the pin assignments for the primary temperature communication and power cable.

from	PM cell		length= ~28'
PT	to	PM power supply & interface box, tmp	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D		+15vdc
E	E		-15vdc
F	F		±15v return
G	G		+8vdc
H	H		+8 return
J	J		spare
K	K		spare

Table 4.1

Cable PR: The MS3126J-12-10S connector is connected to the primary mirror cell interface box. The cables come across the elevation wrap, through the maypole, and through the cable tray to location B. Connection is made with a MS3126F-12-10P connector to the primary mirror power supply. Table 4.1 defines the pin assignments for the primary temperature communication and power cable.

from	PM cell		length= ~28'
PT	to	PM power supply & interface box, tmp	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D		+15vdc
E	E		-15vdc
F	F		±15v return
G	G		+8vdc
H	H		+8 return
J	J		spare
K	K		spare

Table 4.2

Cable PC: The MS3126J-14-19S connector is connected to the primary mirror cell interface box. The cables come across the elevation wrap, through the maypole, and through the cable tray to location B. Connection is made with a MS3126F-14-19P connector to the primary mirror power supply. Table 4.2 defines the pin assignments for the primary communications cable.

from	PM cell		length= ~80'
PC	to	PM power supply & interface box, com	
socket	plug	grouping	description/comments
A	A		shield
B	B		6vac P/S interlock
C	C		6vac P/S interlock
D	D		- spare #2
E	E		+ spare #2
F	F		- spare #1
G	G		+ spare #1
H	H		- RS485 signal 6
J	J		+ RS485 signal 6
K	K		- RS485 signal 5
L	L		+ RS485 signal 5
M	M		- RS485 signal 4
N	N		+ RS485 signal 4
P	P		- RS485 signal 3
R	R		+ RS485 signal 3
S	S		- RS485 signal 2
T	T		+ RS485 signal 2
U	U		- RS485 signal 1
V	V		+ RS485 signal 1

Table 4.3

Cable PP: The G6A18-22-SNE connector is connected to the primary mirror cell interface box. The cables come across the elevation wrap, through the maypole, and through the cable tray to location B. Connection is made with a G6A18-22-PNE connector to the primary mirror power supply. Table 4.3 defines the pin assignments for the primary mirror power cable.

from	PM cell		length= ~80'
PP	to	PM power supply & interface box, pwr	
socket	plug	grouping	description/comments
A	A		shield
B	B		
C	C		
D	D		spare
E	E		+48 return
F	F		+48 return
G	G		+48vdc
H	H		+48vdc
J	J		-15vdc
K	K		-15 return
L	L		-15 sense
M	M		-15 return sense
N	N		+15 return sense
P	P		+15 sense
R	R		+15 return
S	S		+15vdc
T	T		+8 sense
U	U		ground
V	V		ground
W	W		+8 sense
X	X		+8vdc
Y	Y		+8vdc

Table 4.4

5. WIYN Port, SI and IAS

The SI and IAS have not been designed which makes defining cables difficult. General provisions have been made for power and communications to the SI and IAS. SI cables will be terminated in a patch panel on the rotating NIR flange. Short connecting cables must be provided to bridge the gap to the SI. IAS cables will be connected directly to the IAS. Table 5 and figure 5 describe the major cables going to the IAS and SI.

	description	function	dia	connector, from	route description	connector, to	AWG
I/SC1-5	8 cond, 4 twpr	camera control	0.28	MS3126J-12-10S	IAS/SI - loc A/B	MS3126F-12-10P	24
IC	18 cond, 9 stwpr	IAS control	0.38	MS3126J-14-19S	IAS - loc B	MS3126F-14-19P	24
IP	19 cond, shld	IAS DC power	0.75	G6A18-22-SNE	IAS - loc B	G6A18-22-PNE	16
I/SV1-6	RG58/RG59 coax	RS170, video	0.20	UG-89 B/U	IAS/SI - loc A/B	UG-89 B/U	20
SOF	6 path, optical fiber	data, command, comm	0.40	SMT	SI - loc A/B	SMT	
SP	19 cond, shld	general purpose, SI, pwr	0.75	G6A18-22-SNE	SI - loc A/B	G6A18-22-PNE	16
SC	18 cond, 9 stwpr	general purpose, SI, com	0.38	MS3126J-14-19S	SI - loc A/B	MS3126F-14-19P	24

Table 5

Cable I/SC1-5: The MS3126J-12-10S connectors are connected to one camera controller located near the SI interface box and to the three IAS camera controllers near the instrument adapter. The cables are draped across the NIR bearing to the fork tine and routed through the maypole and on to location A or, through the cable tray to location B. Connection is made with a MS3126F-12-10P connectors to the SI controller and IAS controller. Table 5.1 defines the pin assignments for the four IAS/SI camera control cables.

from	SI or IAS		length= ~80'
I/SC1-5	to	Camera controller, loc A or loc B	
socket	plug	grouping	description/comments
A	A		return
B	B		power
C	C		power return
D	D		camera gain
E	E		focus +
F	F		focus -
G	G		filter advance
H	H		filter pos 1
J	J		filter pos 2
K	K		filter pos 3

Table 5.1

Cable IC: The MS3126J-14-19S connector is connected to the IAS interface box. The cables are draped across the NIR bearing to the fork, routed through the maypole, through the cable tray and to location B. Connection is made with a MS3126F-14-19P connector to the IAS controller. Table 5.2 defines the pin assignments for the IAS control cable.

from	IAS interface box		length= ~80'
IC	to	IAS controller, loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
V	V		TBD

Table 5.2

Cable IP: The G6A18-22-SNE connector is connected to the IAS interface box. The cables are draped across the NIR bearing to the fork, routed through the maypole, through the cable tray up to location B. Connection is made with a G6A18-22-PNE connector to the IAS power supply. Table 5.3 defines the pin assignments for the IAS power cable.

from	IAS interface box		length= ~80'
IP	to	IAS power supply, loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
Y	Y		TBD

Table 5.3

Cable SP: The G6A18-22-SNE connector is connected to the SI interface box. The cables are draped across the NIR bearing to the fork, routed through the maypole and on to location A, or through the cable tray to location B. Connection is made with a G6A18-22-PNE connector to the SI power supply and interface box. Table 5.6 defines the pin assignments for the SI power cable.

from	SI interface box		length= ~80'
SP	to	SI power supply, loc A or loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
Y	Y		TBD

Table 5.6

Cable SC: The MS3126J-14-19S connector is connected to the SI interface box. The cables are draped across the NIR bearing to the fork, routed through the maypole and on to location A, or through the cable tray to location B. Connection is made with a MS3126F-14-19P connector to the SI controller. Table 5.7 defines the pin assignments for the SI control cable.

from	SI interface box		length= ~80'
SC	to	SI controller, loc B or loc A	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
V	V		TBD

Table 5.7

6. Hydra

Hydra, the Multi-Object Spectrometer fiber positioner, is run by two boxes, one for position control and the other for driving the positioners. These boxes are expected to be mounted below the observing floor just beneath the telescope skirt where waste heat can be collected and moved to a position away from the observatory. Communication with the Hydra and MOS computer is over two RS232 serial lines. Table 6 describes the cables leaving Hydra going to either the control electronics, drive electronics or the control room. Hydra control electronics consume only 180 watts maximum during configuration, making it possible to share power with other control functions under the skirt. Its power comes from a separate UPS-1 circuit isolating control power from drive power. Figure 6 shows these cables.

	description	function	dia	connector, from	route description	connector, to	AWG
HMX1	Belden T9418, 4 shld	X1 motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMX2	Belden T9418	X2 motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMY	Belden T9418	Y motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMZ	7 cond, shld	Z motor	0.26	757-7-OSN	Hydra - cntrl/Skt	757-7-OPN	22
HRX1	vendor supplied	X1 resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HRX2	vendor supplied	X2 resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HRY	vendor supplied	Y resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HEX	2-2 stwpr	X encoder		757-12-OSN	Hydra - cntrl/Skt	DB-25P	22
HEY	2-2 stwpr	Y encoder		757-7-OSN	Hydra - cntrl/Skt	DB-25P	22
HSC	37 cond	stage control	0.43	757-37-OSN	Hydra - cntrl/Skt	757-37-OPN	24
HCC	7 cond, shld	camera control	0.26	757-12-OSN	Hydra - loc B	757-12-OPN	22
HLC	RG 58	LED control	0.2	KC59-128	Hydra - loc B	hard wired	20
HCV	RG 59	camera video	0.2	KC59-128	Hydra - loc B	KC59-128	20
HCLC	undefined	calibration lamp control			undefined		
HCLP	undefined	calibration lamp power			undefined		
HCM1-2	6 cond, 3 stwpr	RS232 communication	0.23	DB-25S	Hydra - loc B	757-7-OPN	22
HXD	vendor supplied	X drive		DB-25P	cntrl - drvr	DB-25P	
HYD	vendor supplied	Y drive		DB-25P	cntrl - drvr	DB-25P	
HICM	19 cond	com	0.32	DB-25P	cntrl - drvr	DB-25P	24

Table 6

Hydra cables are well defined in the manual, *Fiber Actuated Device, HYDRA.*

7. MOS and WIYN Port NIRs

The MOS and WIYN port NIRs have identical requirements. Each is driven by a DC brushless servo motor for rotating Hydra or the instrument adapter and science instrument. Each has a Heidenhain ROD800 incremental encoder for position feedback with its EXE650 external electronics. Each has a Sony B3 Magnesensor for indicating a unique home position, two limit switches for reporting the end of allowable rotation in either direction, and a center switch to report which side of center the rotator is positioned. Electronics required to support the drives and position sensors will be located at location B. All control signals originate from a motion controller residing on the TCS backplane. Power for the drives comes from a separate DC power supply.

Table 7 and figure 7 describe cables between the NIR system, skirt location and location B. The MOS NIR is designated 1 and the WIYN NIR is designated 2.

	description	function	dia	connector, from	route description	connector, to	AWG
NMD1-2	2 cond	motor drive with tach	0.58	AAP1453G3	NIR - loc B drv	AAP1453G3	16
	6 stwpr (by vendor)	encoder signal, +5	0.30	molded	NIR - fork	22856103	
NE1-2	6 stwpr (purchase)	EXE650		22856114 Conni	fork - loc B intrf	MS3126F-12-10P	
NL1-2	6 cond, 3 stwpr	limit switch	0.25	MS3126J-12-10S	NIR - loc B intrf	MS3126F-12-10P	24
NI1-2	6 cond, shld	index Magnesensor	0.23	MS3126J-12-10S	fork- loc B intrf	MS3126F-12-10P	24
NBS1-2	10 cond, 5 stwpr	brake solenoid control	0.35	MS3126F-12-10S	skirt - loc B intrf	MS3126F-12-10P	24
NP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 7

Cable NMD1-2: The two AAP1453G3 4 position connectors are connected to the NIR rotation motors at their locations in the fork tine. The other end of these cables are connected to AAP1453G1 connectors on the drive power box located at location B. Table 7.1 defines the pin assignments for the two NIR motor drive cables.

from	NIR motor 1 & 2		length= 2@~75'
NMD1-2	to	drive power box, loc B	
socket	terminal	grouping	description/comments
A	A		out +
B	B		out -
C	C		spare
D	D		spare
E	E		tach out +
F	F		tach out -

Table 7.1

Cable NE1-2: The Heidenhain ROD 800 incremental encoder cable at each NIR is connected to their EXE 650 interpolating electronics located in the fork assembly with the 1 meter integral cable. A purchased 22 meter extension cable with our MS3126F-12-10P connector installed, is routed through the maypole and cable tray to the CS interface chassis at location B. Table 7.2 describes the signal and pin assignments for the two NIR encoder cables.

from	ROD800 inc encoder	length= 2@~1m, 2@~22m		to
NE1-2	to	EXE650 electronics, purchased cable		CS loc B
socket	plug	grouping	description/comments	plug
1	1	green	+signal Ie1	A
2	2	yellow	-signal Ie1	B
3	3	brown	+5vdc	C
4	4	white	0vdc	D
5	5	blue	+signal Ie2	E
6	6	red	-signal Ie2	F
7	7	grey	+signal Ie0	G
8	8	pink	-signal Ie0	H
9	9		shield	J
				K

Table 7.2

Cable NL1-2: The MS3126J-12-10S connectors are connected to the limit switch cable near their locations on top and bottom of the NIR. The cable is routed through the fork tine, maypole, cable tray and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 7.3 identifies the pin assignments for the two NIR limit switch cables.

from	limit sw, top of NIR		length= ~75'
NL1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		right rotation hard limit
B	B		right rtn
C	C		left rotation hard limit
D	D		left rtn
E	E		right/left of center switch
F	F		return
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 7.3

Cable NI1-2: The cable coming from each Sony B3 Magnesensor, one for each NIR, is connected to its detector electronics, PD10, in a Buddy box in the fork. A MS3120J-12-10P connector on the box connects to a mating cable connector, MS3126J-12-10S, and routed through the maypole, cable tray, and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 7.4 defines the pin assignments for the NIR index Magnesensor cables.

from	fork index box		length= ~75'
NI1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		A+ output 1,2
B	B		A- output 1,2
C	C		gnd
D	D		gnd
E	E		+12 vdc
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 7.4

Cable NBS1-2: The MS3126F-12-10S connectors are connected to the their brake solenoid and pressure switch in the pier next to the high pressure air supply. The cable is routed from the solenoids and switches to the CS interface chassis and connected with a MS3126F-12-10P connector. An air pressure intensifier mounted in the pier feeds the high pressure air lines through solenoid valves and pressure sensors which are then routed through the maypole to the NIR brake location in each fork tine. Table 7.5 defines the pin assignments for the two MOS and WIYN NIR brake solenoid control cables.

from	brake solenoids		length= 1@~35'
NBS1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		MOS brake cntrl
B	B		MOS cntrl return
C	C		MOS pressure switch
D	D		MOS switch return
E	E		WIYN brake cntrl
F	F		WIYN cntrl return
G	G		WIYN pressure switch
H	H		WIYN switch return
J	J		spare
K	K		spare

Table 7.5

8. Elevation Axis

The elevation axis is driven by two Inland Motor QT7801F torque motors with position feedback coming from a Heidenhain ROD800 incremental encoder, limit switches, and index sensor. The home position sensor is a Sony B3 Magnesensor on the drive sector used for an accurate index position. The drive sector has limit switches on both ends of travel to protect the hard limits at 4.5 and 90.5 degrees. There are also soft limit switches located at 32 and 73 degrees. A tachometer and elevation angle indicators are used to determine speed law violations which, when exceeded, cause an emergency stop. Copley 220 amplifiers reside in the drive power box with battery backup and power supply at location B. Detector electronics for the Sony sensor and Heidenhain encoders reside near them. All motion control signals originate from a motion controller residing on the TCS backplane. Fail-safe disk brakes, held off with high pressure air, are provided to stop azimuth and elevation rotation in case of an emergency, (refer to Azimuth axis discussion section 3, tables 3 and 3.7). If an emergency condition is detected, a solenoid valve is de-energized which opens an orifice and dumps air pressure quickly allowing both elevation and azimuth brakes to engage. The location of the solenoid release valve is in the pier next to the high pressure air supply.

Table 8 and the accompanying figure 8 define the major cables from the elevation sector to the skirt electronics and on to the CS interface chassis at location B.

	description	function	dia	connector, from	route description	connector, to	AWG
EMD1	2 cond	motor1 drive cable	0.58	AAP1452G3	El axis - loc B drv	AAP1453G3	10
EMD2	2 cond	motor2 drive cable	0.58	AAP1452G3	combined EMD1-2	part of EMD1	
	6 stwpr (by vendor)	encoder signal, +5	0.28	molded	El axis - fork	22856103	
EE	6 stwpr (purchase)	EXE650		22856114 Conni	fork - loc B intrf	MS3126F-12-10P	
EL	6 cond, 3 stwpr	limit switch	0.26	MS3126J-12-10S	drive sec- loc B intr	MS3126F-12-10P	24
EI	6 cond, shld	index Magnesensor	0.23	MS3126J-12-10S	El axis - loc B intrf	MS3126F-12-10P	24
ET	6 cond, 3 stwpr	tachometer signal	0.26	MS3126J-12-10S	El axis - loc B intrf	MS3126F-12-10P	24
EAS	10 cond, 5 stwpr	angle sensor(s)	0.35	MS3126J-10-6S	OSS - loc B intrf	MS3126F-10-6P	24
EP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 8

Cable EMD1-2: The two AAP1452G3 4 position connectors are connected to the Elevation drive motors at their locations at each drive disk. The other end of these cables are connected to AAP1452G2 connectors located on the CS drive power box at location B. Table 8.1 defines the pin assignments for the two elevation motor drive cables.

from	El motor 1 & 2	length= 20'–70'
EMD1-2	to	drive power box, loc B
socket	terminal	grouping description/comments
A	A	out +
B	B	out -
C	C	spare
D	D	spare

Table 8.1

Cable EE: The cable from the Heidenhain ROD 800 incremental encoder on the elevation axis is connect to its EXE 650 interpolating electronics located in the fork assembly with the integral 1 meter cable. A purchased 22 meter cable, with our MS3126F-12-10P connector installed, is routed through the maypole and cable tray to the CS interface chassis at location B. Table 8.2 describes the signal and pin assignments for the two elevation encoder cables.

from	ROD800 inc encoder	length= 2@~1 m, 2@~22 m	to
EE	to	EXE650 electronics, purchased cable	CS loc B
socket	plug	grouping	description/comments	plug
1	1	green	+signal le1	A
2	2	yellow	-signal le1	B
3	3	brown	+5vdc	C
4	4	white	0vdc	D
5	5	blue	+signal le2	E
6	6	red	-signal le2	F
7	7	grey	+signal le0	G
8	8	pink	-signal le0	H
9	9		shield	J
				K

Table 8.2

Cable EL: The MS3126J-12-10S connector is connected to the limit switches at their locations on the fork tine. The cable is routed through the fork tine, maypole, cable tray, and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 8.3 identifies the pin assignments for the elevation limit switch cable.

from	El limit sw, drv sectr	length= ~70'	
EL	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		CW rotation soft limit
B	B		CW rtn
C	C		CCW rotation soft limit
D	D		CCW rtn
E	E		CW rotation hard limit
F	F		CW rtn
G	G		CCW rotation hard limit
H	H		CCW rtn
J	J		spare
K	K		spare

Table 8.3

Cable EI: The cable coming from the Sony B3 Magnesensor is connected to its detector electronics, PD10, in a Buddy box in the fork. A MS3120J-12-10P connector on the box connects to a mating cable connector, MS3126J-12-10S, and routed through the maypole, cable tray, and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 8.4 defines the pin assignments for the elevation index Magnesensor cable.

from	index sensor, El axis	length= ~70'	
EI	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		A+ output 1,2
B	B		A- output 1,2
C	C		+12 vdc
D	D		gnd
E	E		gnd
F	F		shield
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 8.4

Cable ET: The cable with a MS3126J-12-10S connector is connected to the tachometer located on the fork tine and is driven by one of the elevation axis drive disk sectors. The cable is routed from the tachometer location through the fork, maypole, cable tray, and connected with a MS3126F-12-10P connector to the CS interface chassis at location B. Table 8.5 defines the pin assignments for the elevation tachometer cable.

from	tachometer, El axis		length= ~60'
ET	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		Output +
B	B		Output -
C	C		shield
D	D		spare
E	E		spare
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 8.5

Cable EAS: The cable with a MS3126J-12-10S connector is connected to the angle sensors connector located on the OSS or center section. The cable is routed across the elevation wrap, through the fork, maypole, cable tray, and connected with a MS3126F-12-10P connector to theCS interface chassis at location B. Table 8.6 defines the pin assignments for the elevation angle sensor cable.

from	angle sensor(s), OSS		length= ~90'
EAS	to	CS interface chassis at loc B	
plug	plug	grouping	description/comments
A	A		20 deg switch
B	B		20 deg switch return
C	C		30 deg switch
D	D		30 deg switch return
E	E		85 deg switch
F	F		85 deg switch return
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 8.6

9. OSS Control Subsystem

The tertiary design is not yet complete, so the cables going to that area are estimated. The OSS functions are known; implementation is in progress. A low power CPU will reside on the OSS to control temperature information gathering, mirror cover opening and closing, counter balance position, flat field lamps, secondary and tertiary mirror support, and tertiary motion. The communication link will be RS485. Secondary mirror motions will be controlled by the OSS controller through the RS485 link.

Table 9 and the accompanying figure 9 define the major cables that start at the OSSCS and Tertiary and go to the CS interface chassis at location B. Figure 10 shows cables originating on the OSS and tertiary that go to the OSS controller.

	description	function	dia	connector, from	route description	connector, to	AWG
O/TCom	9 cond, 1 stwpr, 7 pwr	RS485 comm to OSS	0.38	MS3126J-12-10S	OSS cntrlr to loc B	MS3126F-12-10P	24
OP	12 cond, shld	OSS power	0.75	G6A18-22-SNE	pwr, cntr sec to B	G6A18-22-PNE	16
OS	9 cond, 1 stwpr, 7 pwr	RS485 to secondary	0.28	MS3126J-12-10S	OSS, sp cable	MS3126F-12-10P	24
OTemp	9 cond, 1 stwpr, 7 pwr	RS485 to thermocoupler	0.28	MS3126J-12-10S	OSSCS	MS3126F-12-10P	24
OFFL	18 cond, 9 stwpr	flat field lamps + sensors	0.5	MS3126J-14-19S	OSS to ctrlr	MS3126J-14-19P	20
OCB1-2		counter balance control		MS3126J-12-10S	cb to ctrlr	MS3126J-12-10P	20
OMC1-2		mirror cover control		MS3126J-12-10S	mc to ctrlr	MS3126J-12-10P	20
TR	18 cond, 9 stwpr		0.38	MS3126J-14-19S	tertiary rot to ctrlr	MS3126J-14-19P	24
TF				MS3126J-12-10S	tertiary flip to ctrlr	MS3126J-12-10P	
T-SCtrl	18 cond, 9 stwpr		0.38	MS3126J-14-19S	solenoid pier - ctrlr	MS3126J-14-19P	24
SLC1-3	6 cond, 3 stwpr	load cell to preamp	0.23	MS3126J-10-6S	to sec'dary preamp	MS3126F-10-6P	24
SLC		load cell preamp to ctrlr		MS3126J-12-10S	sec'dary to ctrlr	MS3126J-12-10P	
TLC1-3	6 cond, 3 stwpr	load cell to preamp	0.23	MS3126J-10-6S	to tertiary preamp	MS3126F-10-6P	24
TLC		load cell preamp to ctrlr		MS3126J-12-10S	tertiary to ctrlr	MS3126J-12-10P	
OCCM-F	18 cond, 9 stwpr	gen, mod&fold cass	0.38	MS3126J-14-19S	cntr sec to loc B	MS3126F-14-19P	24
OCPM-F	12 cond, shld	gen, mod&fold cass, pwr	0.75	G6A18-22-SNE	pwr, cntr sec to B	G6A18-22-PNE	16
O/TCtrl	6 cond, 3 stwpr	control cable	0.23	MS3126J-10-6S	cntr sec to loc B	MS3126F-10-6P	24

Table 9

Cable O/TCom: The MS3126J-12-10S connector is connected to OSS controller located on the center section. The cable crosses the elevation wrap and is routed through the maypole and cable tray to location B. Connection is made with a MS3126F-12-10P connector to the CS interface chassis. Table 9.1 defines the pin assignments for the OSS/Tertiary communications cable. Figures 9 and 10 show the cable layouts for the OSS controller.

from	OSS controller		length= ~80'
O/TCom	to	CS interface chassis, loc B	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D		spare
E	E		spare
F	F		spare
G	G		spare
H	H		spare
J	J		spare
K	K		spare

Table 9.1

Cable OP: The G6A18-22-SNE connector is connected to the OSS controller. The cables cross the elevation wrap to the fork and are routed through the maypole and cable tray, and on to location B. Connection is made with a G6A18-22-PNE connector to the OSS power supply. Table 9.2 defines the pin assignments for the OSS power cable.

from	OSS controller, OSS		length= ~80'
OP	to	OSS power supply, loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
Y	Y		TBD

Table 9.2

Cable OS: The MS3126J-12-10S connector is connected to the secondary mirror cell interface and control box. The cables are routed across the secondary support and down the OSS to the center section and OSS controller. Connection is made with a MS3126F-12-10P connector to the OSS controller. Table 9.3 defines the pin assignments for the secondary RS485 communications and power cable.

from	Secondary Mir cell		length= ~28'
OS	to	OSS controller, secondary control	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D	TBD	+15vdc
E	E	TBD	-15vdc
F	F	TBD	±15v return
G	G	TBD	+8vdc
H	H	TBD	+8 return
J	J	TBD	+48vdc
K	K	TBD	+48 return

Table 9.3

Cable OTemp: The MS3126J-12-10S connector is connected to the Thermocoupler box on the center section and routed to the OSS controller. Connection is made with a MS3126F-12-10P connector. Table 9.4 defines the pin assignments for the Thermocoupler communications cable.

from	Thermocoupler		length= ~28'
OTemp	to	OSS controller, read OSS temps	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D	TBD	
E	E	TBD	
F	F	TBD	
G	G	TBD	
H	H	TBD	
J	J	TBD	
K	K	TBD	

Table 9.4

Cable OFFL: The MS3126J-14-19S connector is connected to the flat field lamps on top of the OSS. The cable is routed down the OSS to the center section and controller box. Connection is made with a MS3126F-14-19P connector to the OSSCS. Table 9.5 defines the pin assignments for the flat field lamp control cable.

from	flat field lamps on OSS		length= ~30'
OFFL	to	OSS controller	
socket	plug	grouping	description/comments
A	A		shield
B	B		bank 1 power
C	C		bank 1 power
D	D		bank 1 power
E	E		bank 1 return
F	F		bank 1 return
G	G		bank 1 return
H	H		bank 2 power
J	J		bank 2 power
K	K		bank 2 power
L	L		bank 2 return
M	M		bank 2 return
N	N		bank 2 return
P	P		bank 1 sensor
R	R		return
S	S		bank 2 sensor
T	T		return
U	U		
V	V		

Table 9.5

Cable OCB1-2: A MS3126J-12-10S connector is connected to each counter balance unit on the center section and routed to the OSS controller. Connection is made with a MS3126J-12-10P connector. Table 9.6 defines the pin assignments for the counter balance control cables.

from	counter balance		length= ~15'
OCB1-2	to	OSS controller, CB control	
socket	plug	grouping	description/comments
A	A		AC motor power
B	B		AC motor power
C	C		
D	D		AC brake control
E	E		AC brake control
F	F		
G	G		+5vdc for pot
H	H		+5 return
J	J		pot wiper position
K	K		shield

Table 9.6

Cable OMC1-2: A MS3126J-12-10S connector is connected to each mirror cover motor and switches on the center section and routed to the OSS controller. Connection is made with a MS3126F-12-10P connector. Table 9.7 defines the pin assignments for the mirror cover control cables.

from	mirror cover		length= ~28'
OMC1-2	to	OSS controller, MC control	
socket	plug	grouping	description/comments
A	A		DC motor +
B	B		DC motor -
C	C		
D	D		brake +
E	E		brake -
F	F		
G	G		open limit switch
H	H		return
J	J		closed limit switch
K	K		return

Table 9.7

Cable TR: The MS3126J-14-19S connector is connected to the tertiary rotator control connector on the mirror cell interface box and routed to the controller box. Connection is made with a MS3126F-14-19P connector to the OSSCS. Table 9.8 defines the pin assignments for the tertiary rotator control cable.

from	mirror cell interface		length= ~10'
TR	to	OSS controller	
socket	plug	grouping	description/comments
A	A		shield
B	B		motor control
C	C		motor control
D	D		
E	E		position switch 1
F	F		1 return
G	G		position switch 2
H	H		2 return
J	J		position switch 3
K	K		3 return
L	L		latch pin switch
M	M		return
N	N		
P	P		
R	R		
S	S		
T	T		
U	U		
V	V		

Table 9.8

Cable TF: A MS3126J-12-10S connector is connected to tertiary mirror flip unit on the mirror cell. The cable is routed across the mirror cell, up to the center section and to the OSS controller. Connection is made with a MS3126J-12-10P connector. Table 9.9 defines the pin assignments for the tertiary mirror flip control cables.

from	tertiary flip unit		length= ~15'
TF	to	OSS controller, tertiary flip control	
socket	plug	grouping	description/comments
A	A		+DC motor power
B	B		-DC motor power
C	C		
D	D		redundant overtorque down
E	E		down switch return
F	F		redundant overtorque up
G	G		up switch return
H	H		flip up end of travel switch
J	J		flip up switch return
K	K		shield

Table 9.9

Cable T-SCtrl: The MS3126J-14-19S connector is connected to the solenoid and pressure pump connector in the pier. The cable is routed up through the maypole and elevation wrapup to the center section and OSS controller box. Connection is made with a MS3126F-14-19P connector to the OSSCS. Table 9.10 defines the pin assignments for the tertiary/secondary air bag pressure control cable.

from	solenoid pier loc		length= ~60'
T-SCtrl	to	OSS controller	
socket	plug	grouping	description/comments
A	A		shield
B	B		solenoid control 1
C	C		1 return
D	D		solenoid control 2
E	E		2 return
F	F		solenoid control 3
G	G		3 return
H	H		solenoid control 4
J	J		4 return
K	K		
L	L		air pump on
M	M		pump return
N	N		
P	P	TBD	air regulator?
R	R	TBD	pressure sensor?
S	S	TBD	
T	T	TBD	
U	U	TBD	
V	V	TBD	

Table 9.10

Cable SLC1-3: A MS3126J-10-6S connector is connected to each load cell on the secondary mirror cell and routed to the preamp. Connection is made with a MS3126J-10-6P connector. Table 9.12 defines the pin assignments for the secondary load cell cables.

from	secondary load cell		length= ~4'
SLC1-3	to	load cell preamp, for vac bag control	
socket	plug	grouping	description/comments
A	A		+10vdc
B	B		output 1 +
C	C		output 1 -
D	D		-10vdc
E	E		spare
F	F		spare

Table 9.11

Cable SLC: A MS3126J-12-10S connector is connected to the secondary load cell preamp on the secondary mirror cell. The cable is routed down the OSS to the center section and OSS controller. Connection is made with a MS3126J-12-10P connector. Table 9.12 defines the pin assignments for the secondary load cell preamp cable.

from	secondary load cell pr	length= ~30'	
SLC	to	OSS controller, vac bag control	
socket	plug	grouping	description/comments
A	A		+10vdc
B	B		-10vdc
C	C		output 1 +
D	D		output 1 -
E	E		
F	F		output 2 +
G	G		output 2 -
H	H		
J	J		output 3 +
K	K		output 3 -

Table 9.12

Cable TLC1-3: A MS3126J-10-6S connector is connected to each tertiary load cell on the center tertiary mirror cell and routed to the preamp. Connection is made with a MS3126J-10-6P connector. Table 9.13 defines the pin assignments for the tertiary load cell cables.

from	tertiary load cell	length= ~4'	
TLC1-3	to	load cell preamp, for air bag control	
socket	plug	grouping	description/comments
A	A		+10vdc
B	B		output 1 +
C	C		output 1 -
D	D		-10vdc
E	E		
F	F		

Table 9.13

Cable TLC: A MS3126J-12-10S connector is connected to the tertiary load cell preamp on the tertiary mirror cell and routed to the OSS controller. Connection is made with a MS3126J-12-10P connector. Table 9.14 defines the pin assignments for the tertiary load cell preamp cable.

from	tertiary load cell preamp	length= ~15'	
TLC	to	OSS controller, air bag control	
socket	plug	grouping	description/comments
A	A		+10vdc
B	B		-10vdc
C	C		output 1 +
D	D		output 1 -
E	E		
F	F		output 2 +
G	G		output 2 -
H	H		
J	J		output 3 +
K	K		output 3 -

Table 9.14

Cable OCCM-F: The MS3126J-14-19S connectors are connected to the modified and folded cassegrain interface connectors on the center section. The cables cross the elevation wrap to the fork and are routed through the maypole and cable tray to location B. Connection is made with a MS3126F-14-19P connector to the cassegrain instrument controller. Table 9.15 defines the pin assignments for the two OSS cassegrain control cable.

from	Cass interface box	length= ~80'	
OCCM-F	to	Cass controller, loc A or loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
.	.		.
.	.		.
.	.		.
V	V		TBD

Table 9.15

Cable OCPM-F: The G6A18-22-SNE connectors are connected to the modified and folded cassegrain interface power connectors on the center section. The cables cross the elevation wrap to the fork and are routed through the maypole and cable tray to location B. Connection is made with a G6A18-22-PNE connector to the cassegrain power supply. Table 9.16 defines the pin assignments for the two OSS cassegrain power cables.

from	Cass interface box		length= ~80'
OCPM_F	to	Cass power supply, loc A or loc B	
socket	plug	groupmg	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
Y	Y		TBD

Table 9.16

Cable O/TCtrl: TBD.

from	control		length= ~80'
O/TCtrl	to	control	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-			-
-			-
-			-
			TBD

Table 9.17

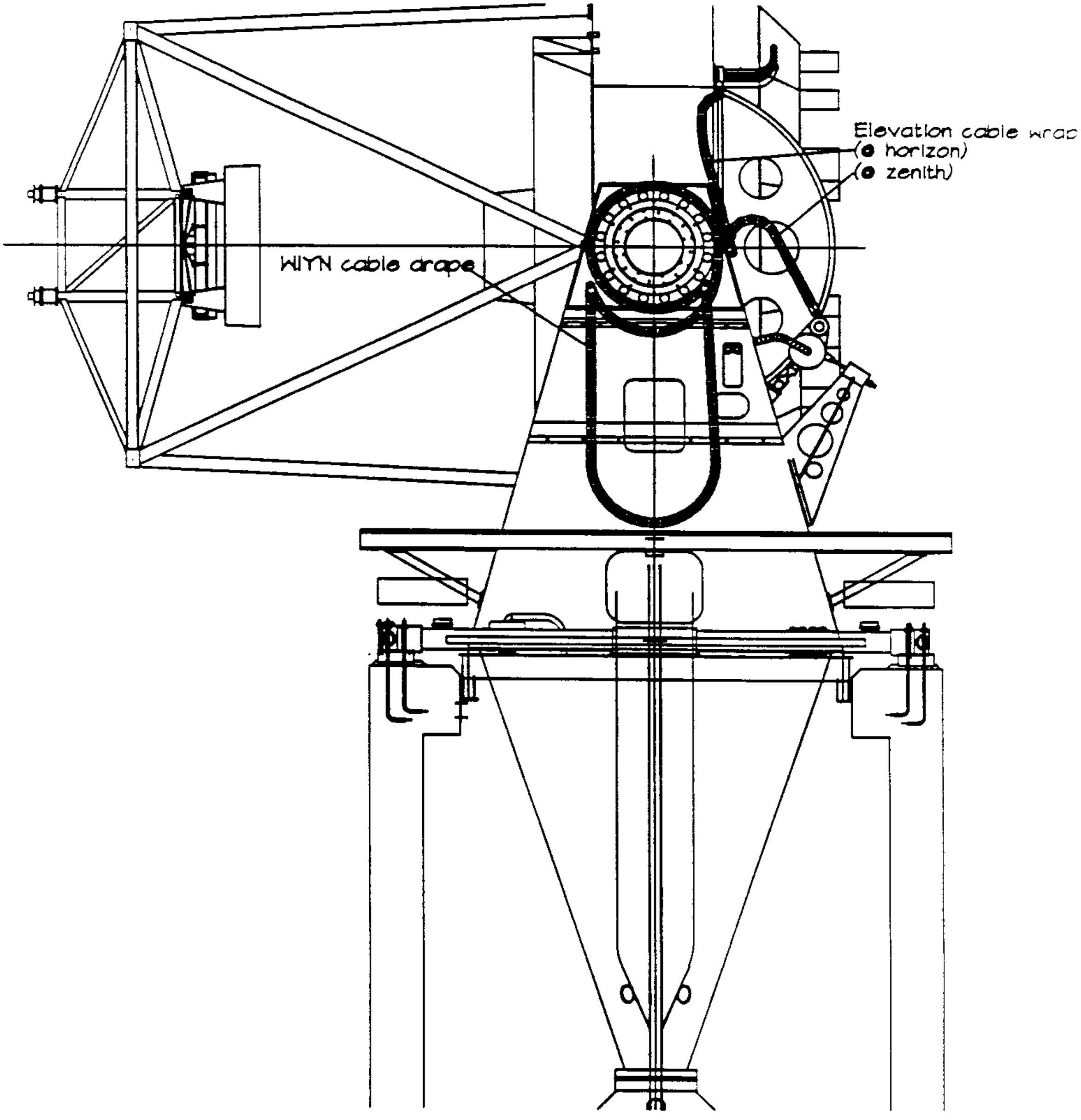
10. AC Power Distribution on the Telescope

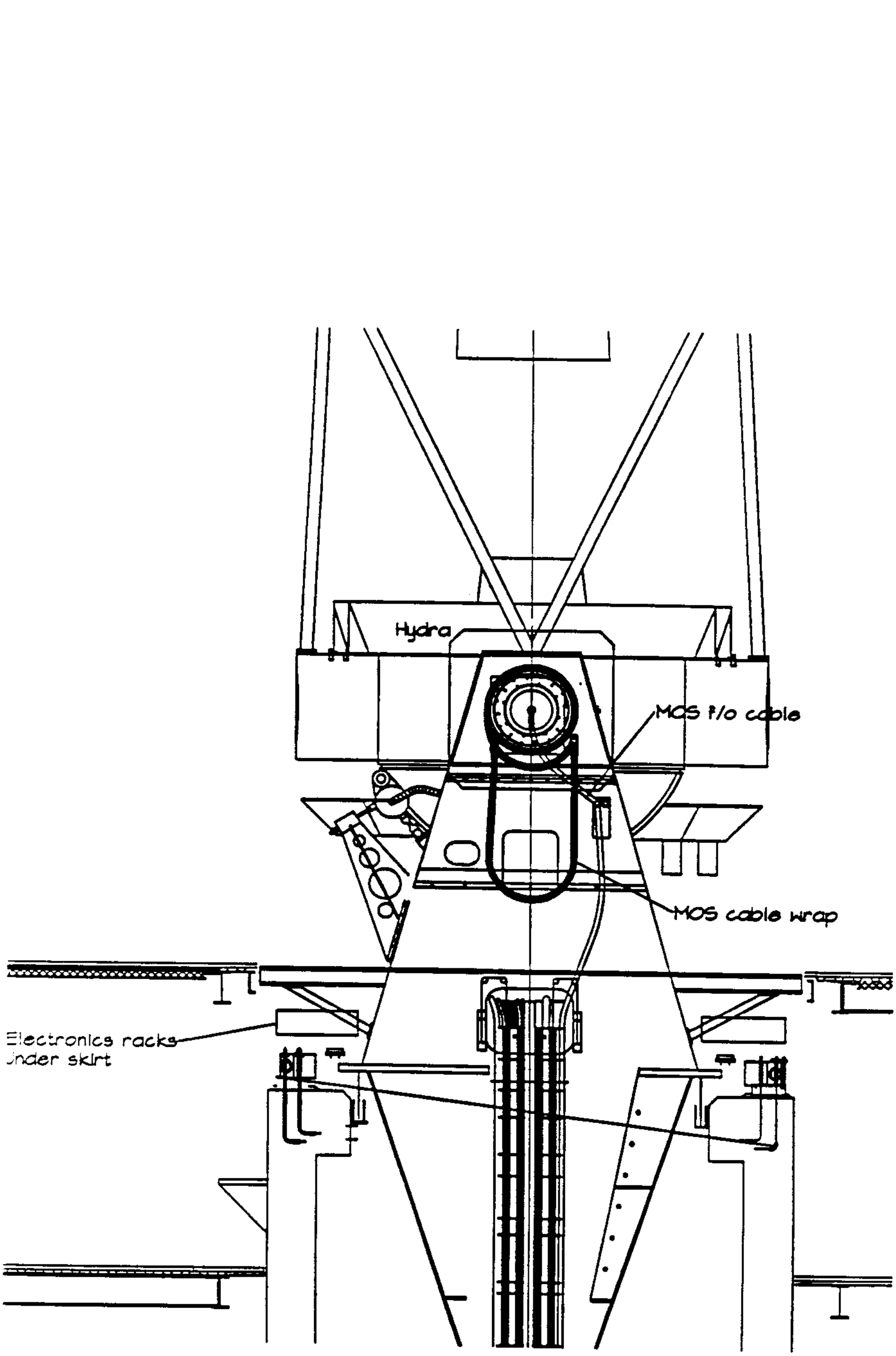
The AC power for telescope consumption is routed to terminal strips under the mesh floor inside the pier by the enclosure contractor. Supply cables are routed through the maypole to the various destinations on the telescope. These comprise 3 AC Mountain power circuits for outlets, motors and general use; 3 AC UPS-1 power circuits for instrument control and controller power; and 3 AC UPS-2 power circuits for drive power for Hydra and the elevation and NIR axes. A fourth UPS-2 circuit is connected directly to the stationary azimuth drive power supply.

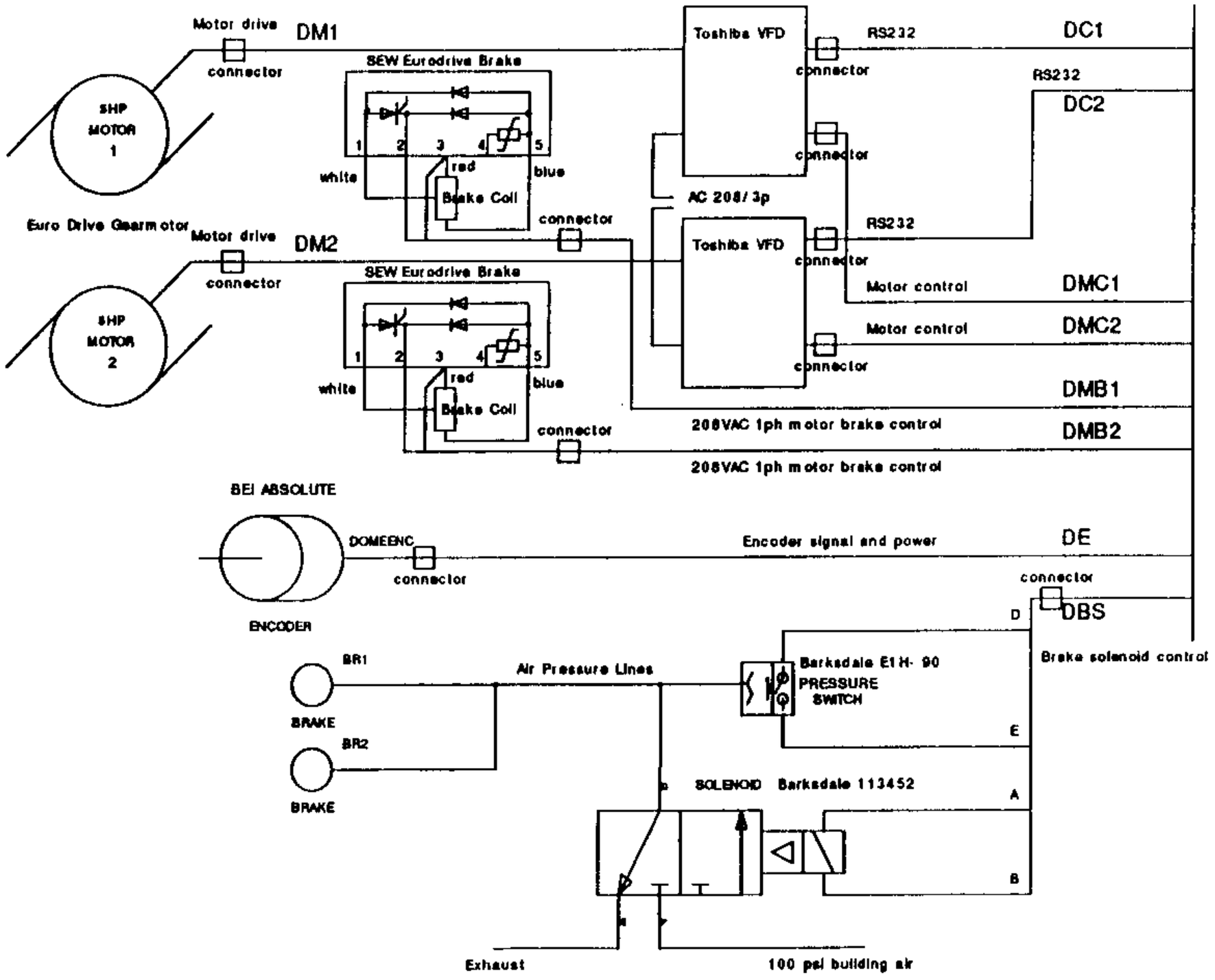
The following table 10 describes the power distribution circuits.

	description	function	dia	connector, from	route description	connector, to	AWG
ACMB	3 cond, 20Amp	AC,mtn ckt 1, blowers	0.64	terminal strip	-	PM cell	12
ACMO	3 cond, 20Amp	AC,mtn ckt 2, OSS	0.64	terminal strip	-	OSS	12
ACMG	3 cond, 20Amp	AC,mtn ckt 3, general	0.64	terminal strip	3 outlets		12
ACU1SK	3 cond, 20Amp	AC,UP-2 ckt 13, skirt	0.64	terminal strip	up13,210	Hydra & MOS	12
ACU1W	3 cond, 20Amp	AC,UP-2 ckt 15, WIYN	0.64	terminal strip	up15,1000	WIYN Port	12
ACU1O	3 cond, 20Amp	AC,UP-2 ckt 17, OSS	0.64	terminal strip	up17,1050	OSS	12
ACU2H	3 cond, 20Amp	AC,UP-2 ckt 8,HydraDr	0.69	terminal strip	skirt	Hydra drive	10

Table 10


Elevation cable wrap
(● horizon)
(● zenith)
WIYN cable drape


Hydra
MOS P/O cable
MOS cable wrap
Electronics racks
under skirt



Control System

Figure 2 Dome Azimuth Drive

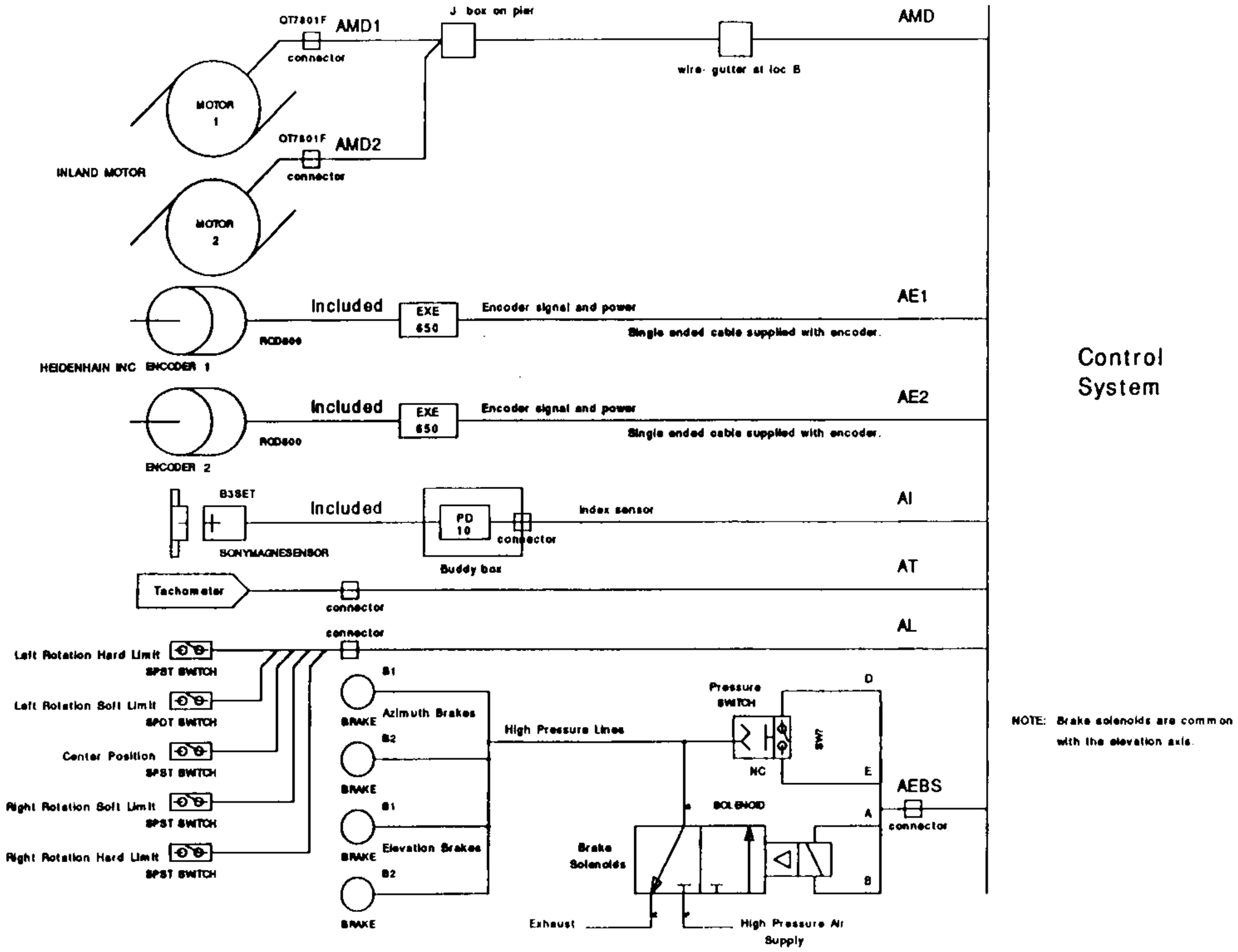


Figure 3 Telescope Azimuth Drive

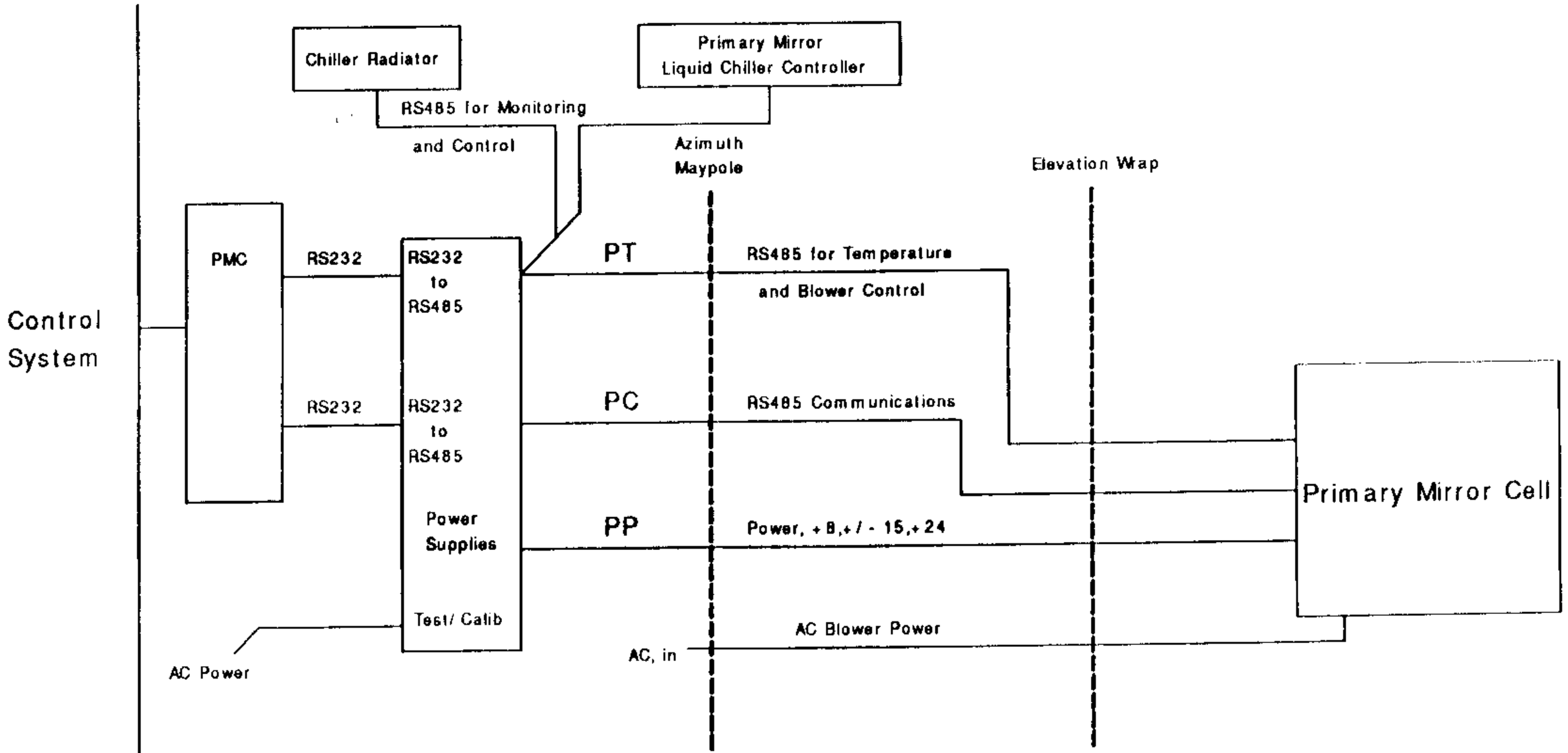


Figure 4 Primary Mirror Subsystem

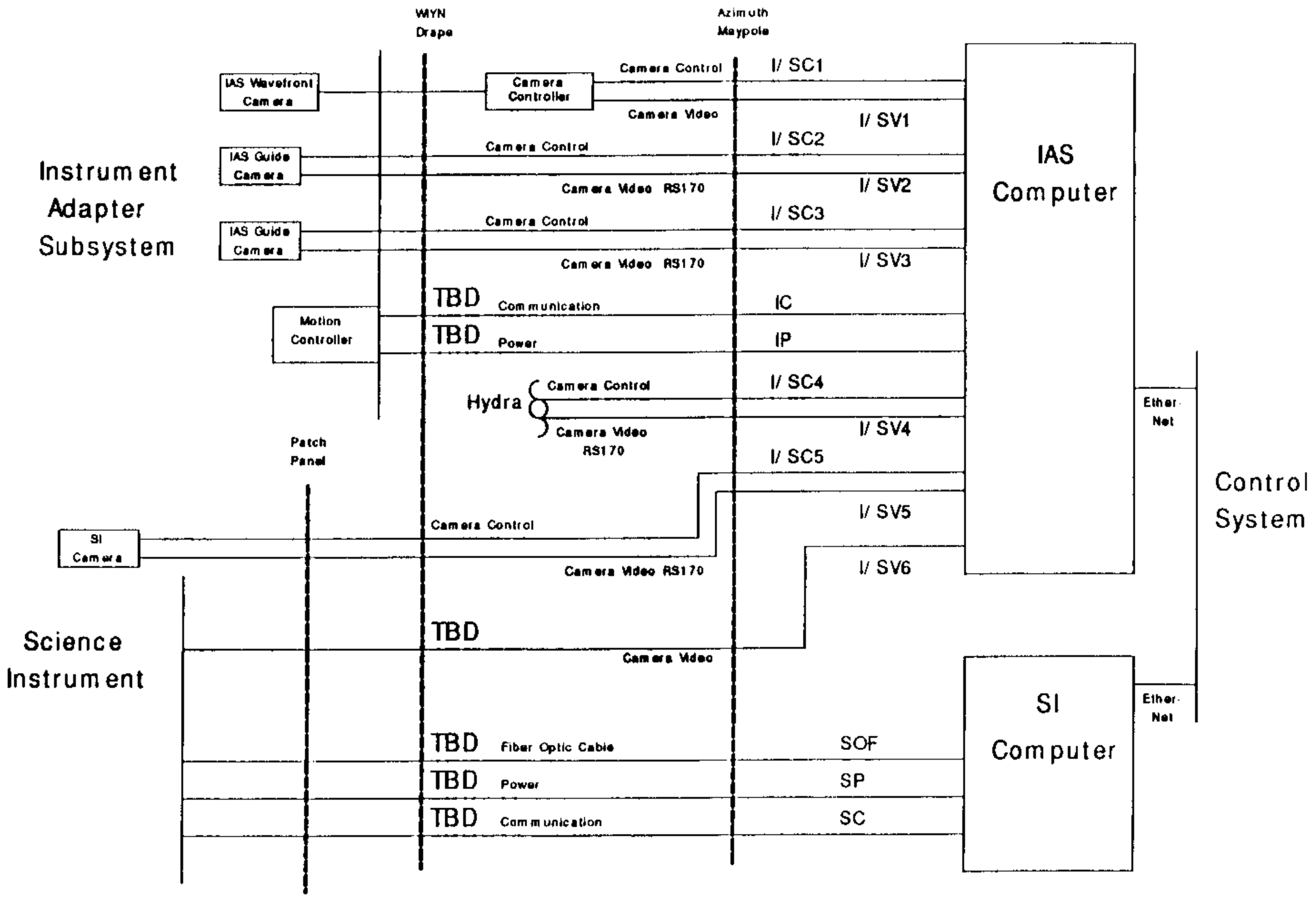


Figure 5 WIYN Port, SI and IAS

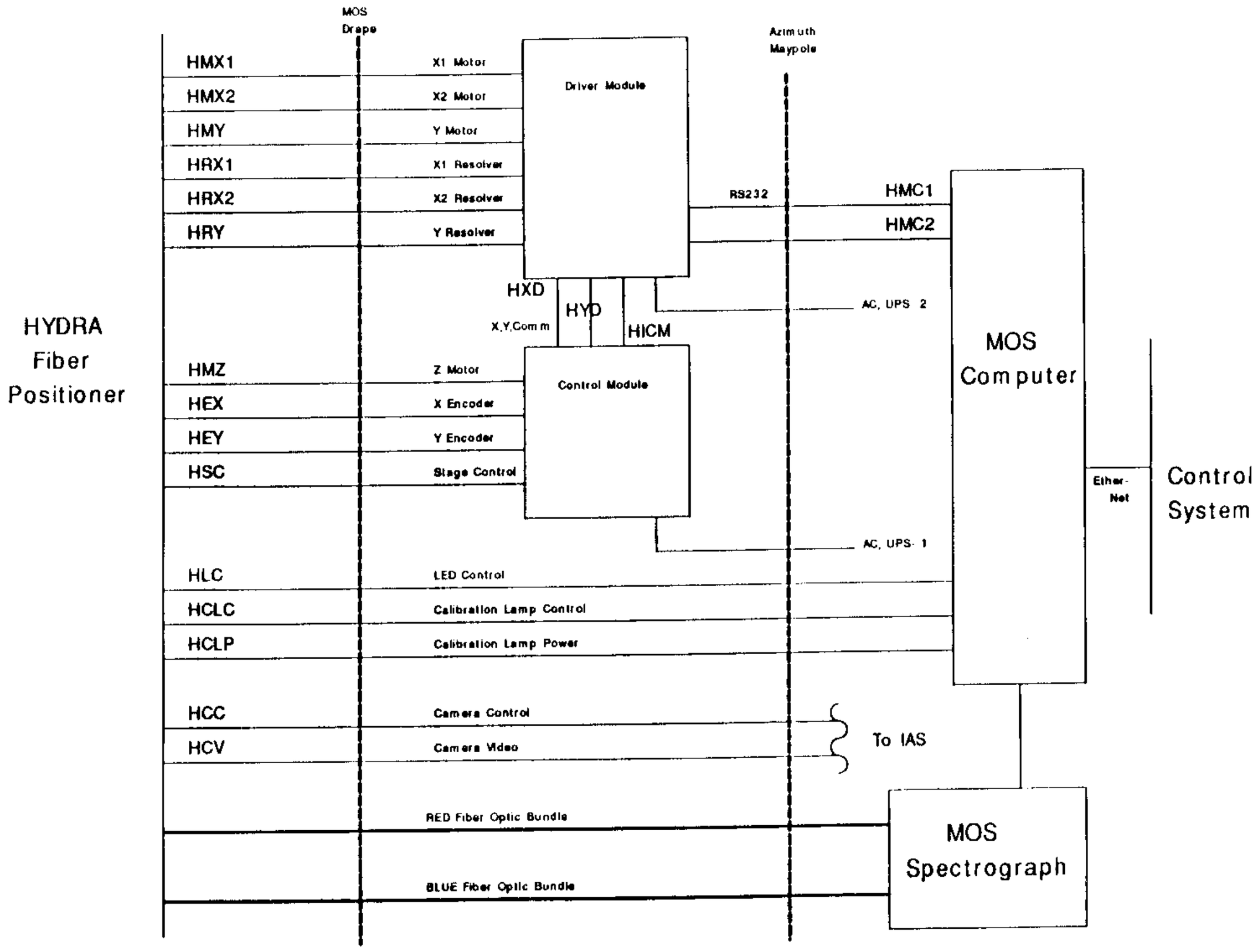


Figure 6 Hydra and MOS

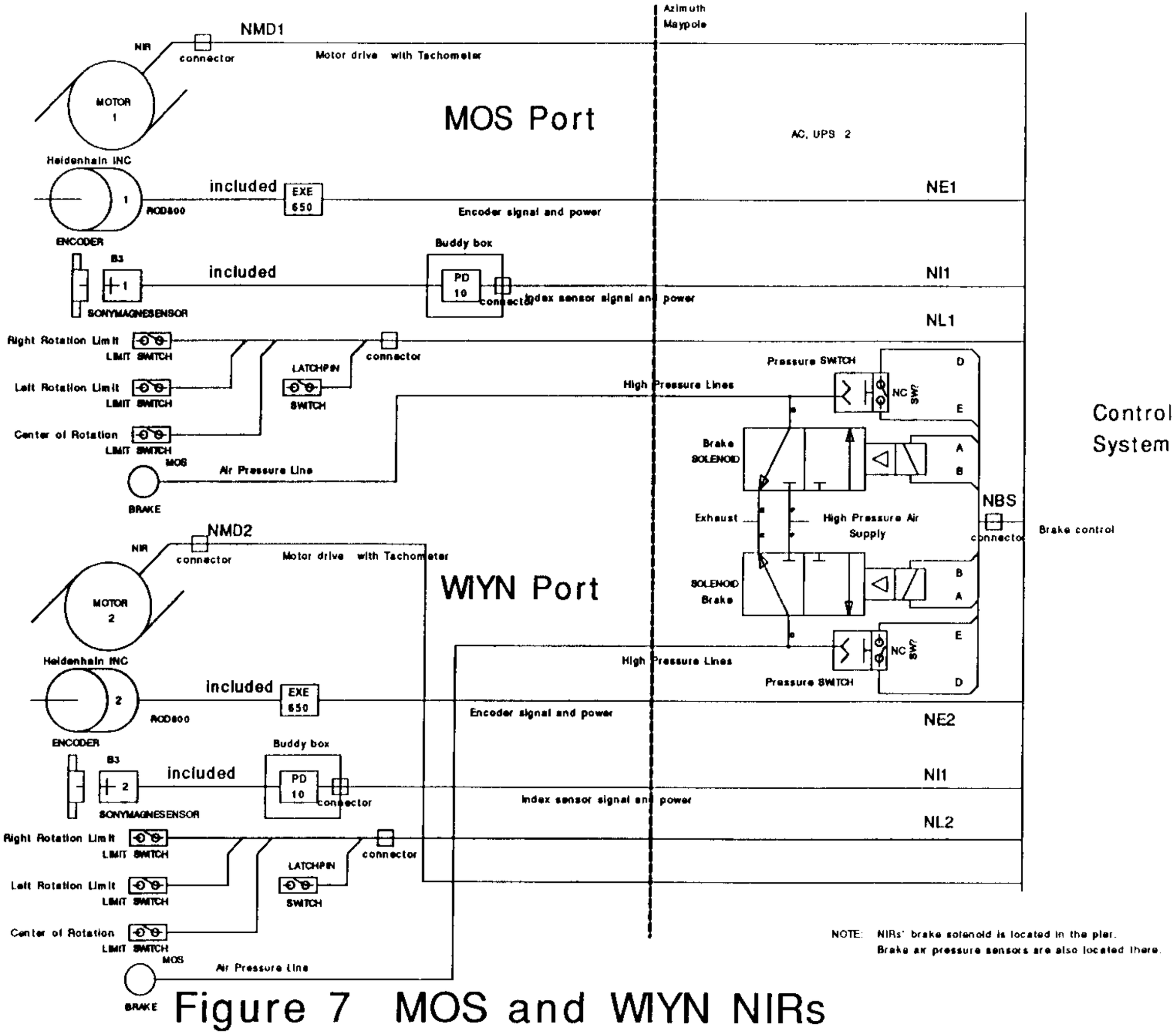
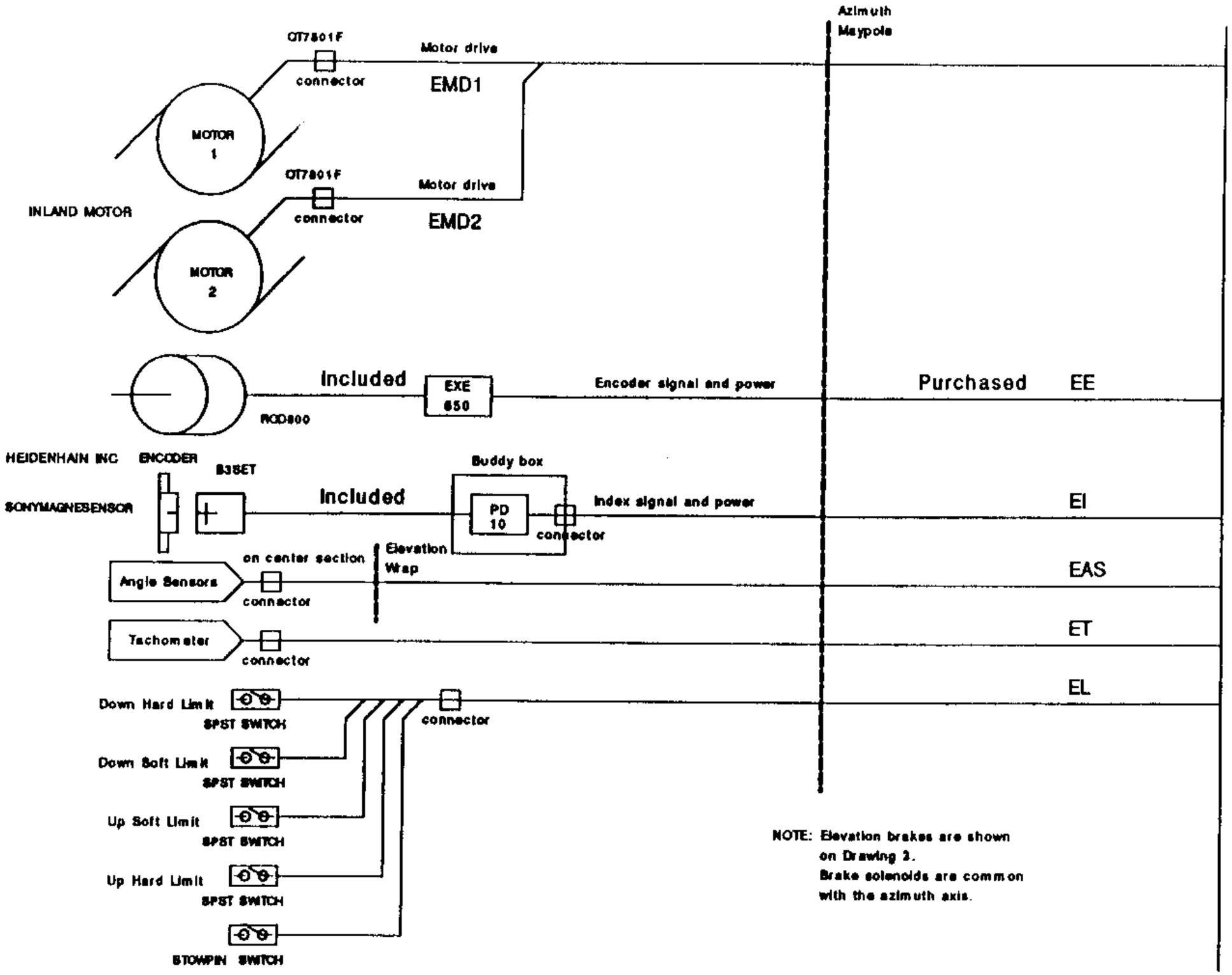


Figure 7 MOS and WYN NIRs



Control System

Figure 8 Telescope Elevation Drive

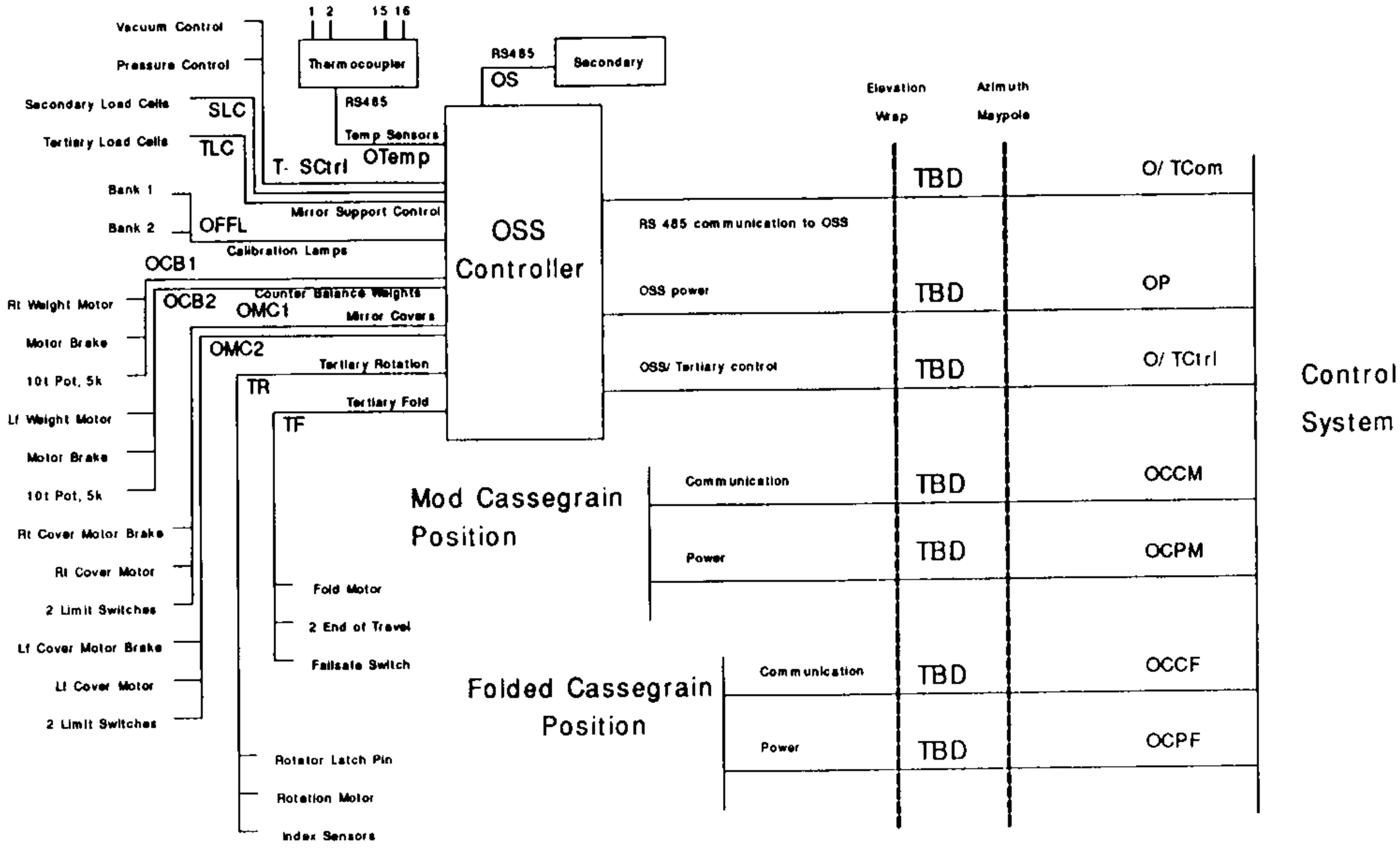
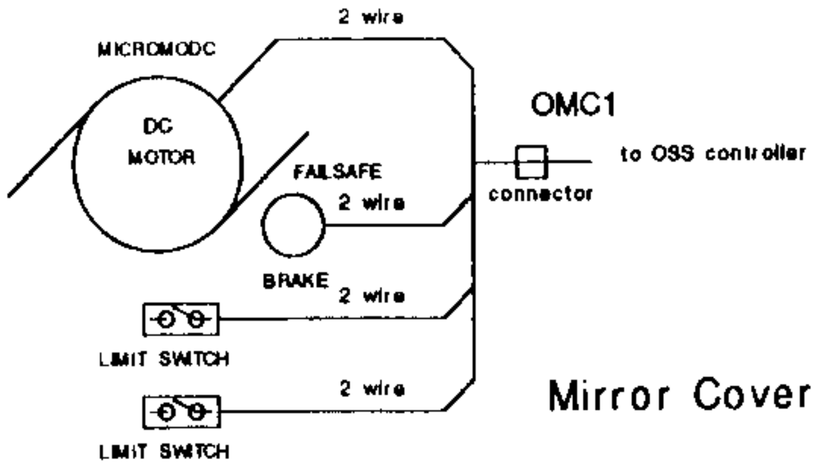
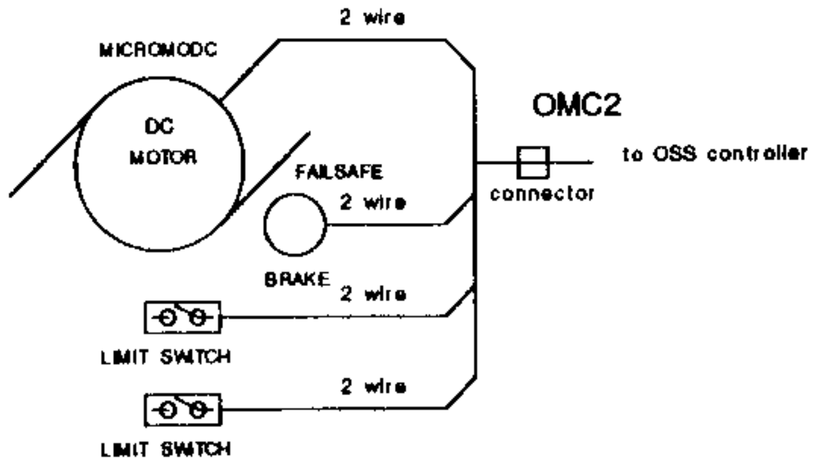
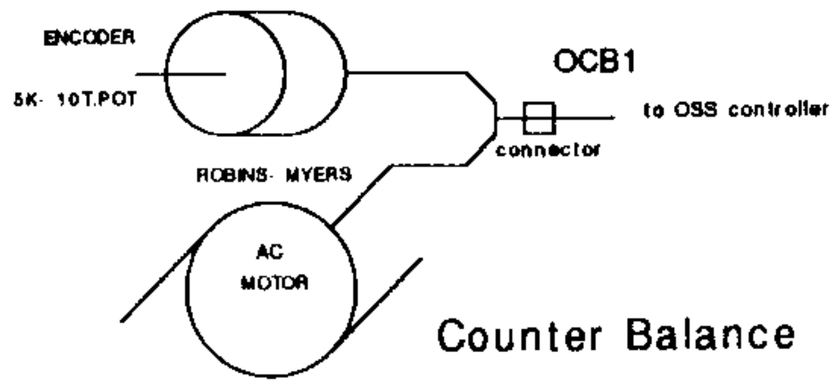


Figure 9 OSS Control Subsystem

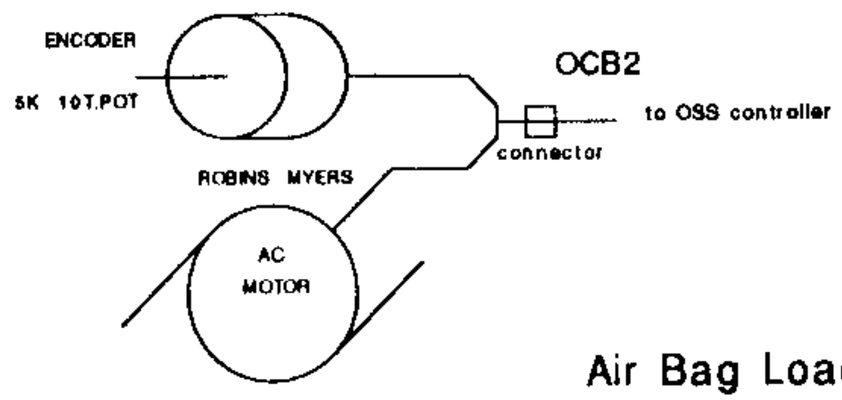


Mirror Cover

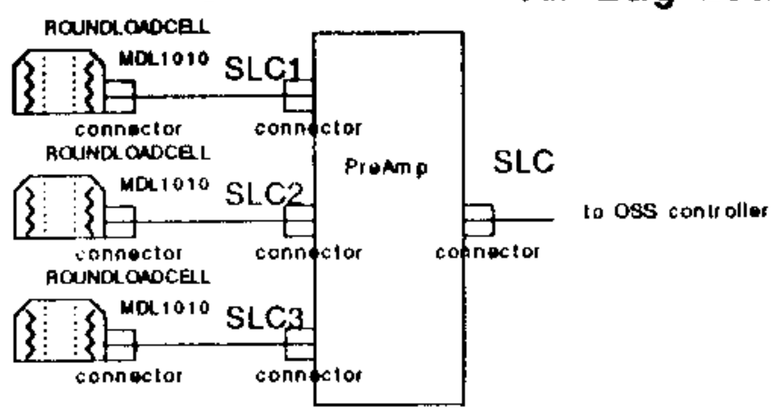


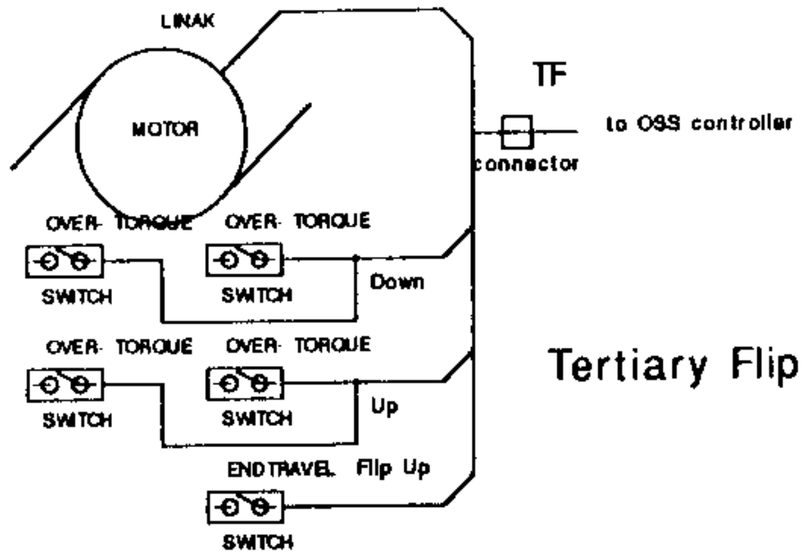


Counter Balance

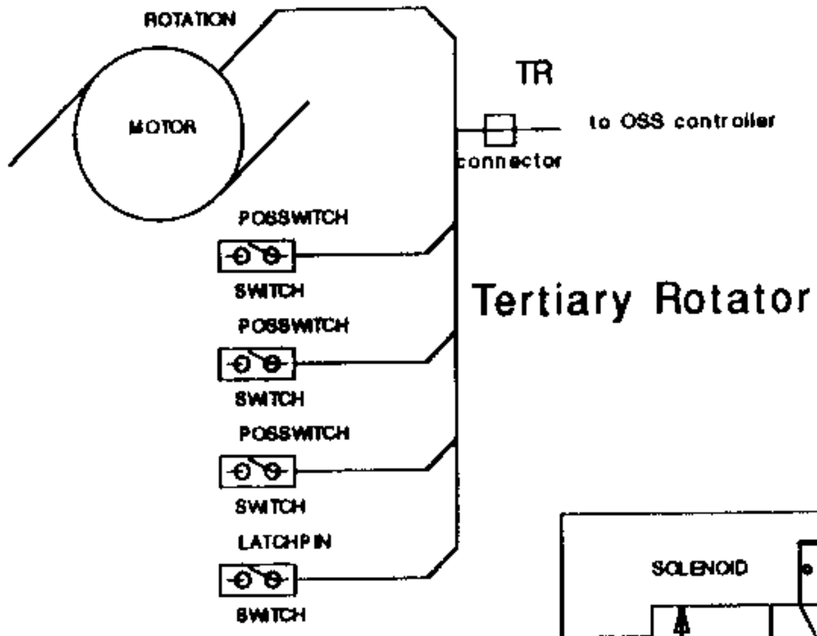


Air Bag Load Sensor

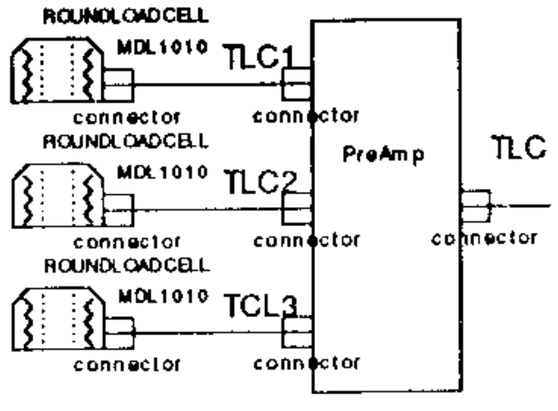


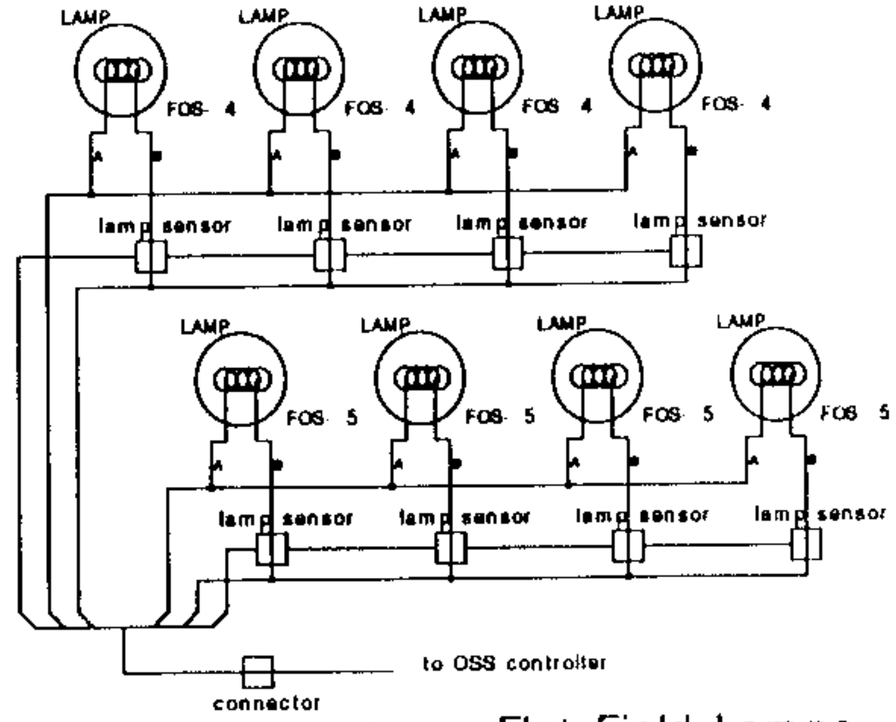


Tertiary Flip



Tertiary Rotator





Flat Field Lamps

Tertiary/ Secondary
Mirror air/ vac control

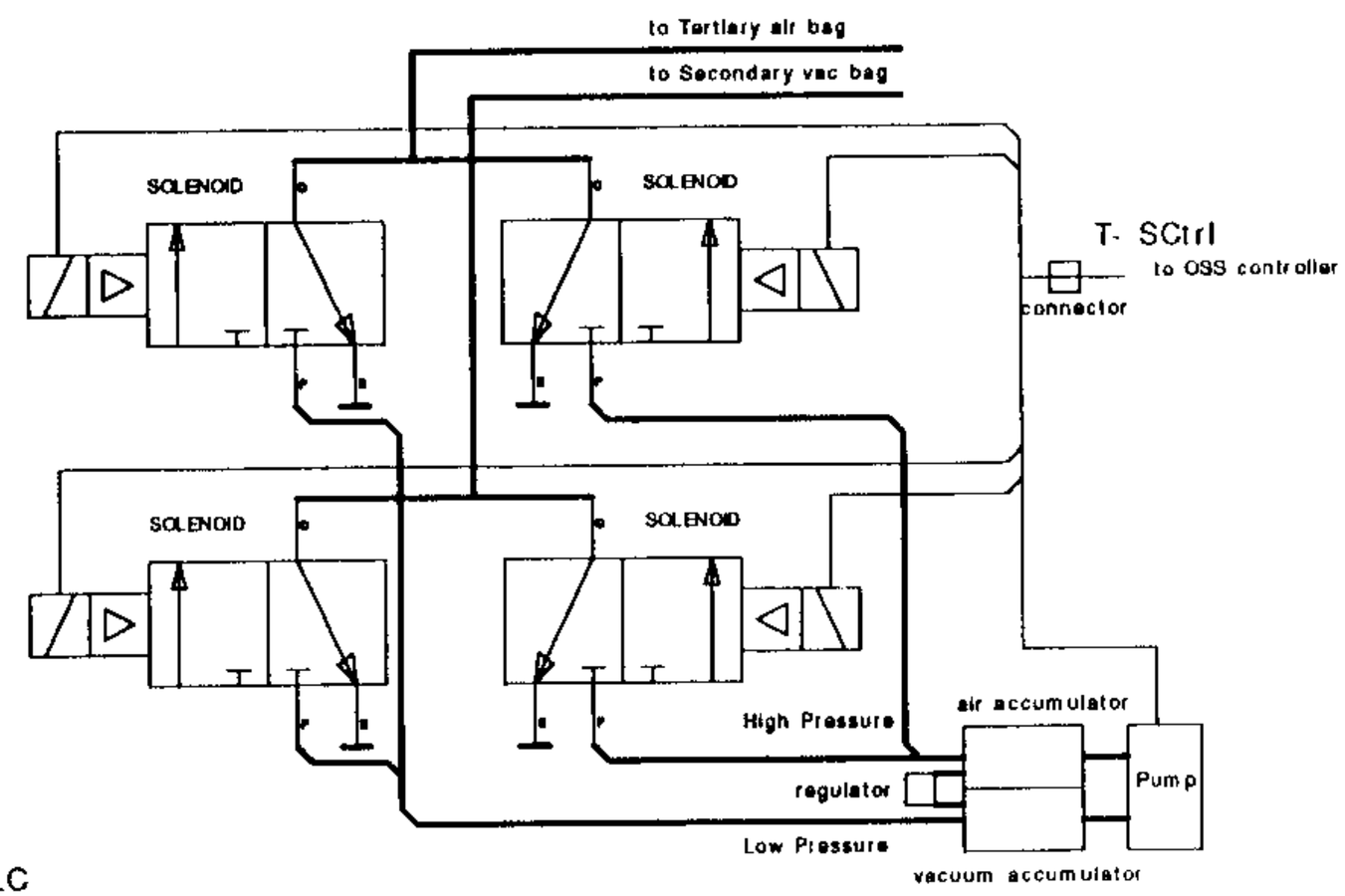


Figure 10 OSS Connections

Appendix A

	description	function	dia	connector, from	route description	connector, to	AWG
DE	18 cond,+5,gnd, shld	absolute encoder cable	0.38	MS3126J-14-19S	encoder - loc B	MS3126F-14-19P	24
DBS	4 cond shld	brake solenoid control	0.36	MS3126J-10-6S	air to both brakes	MS3126F-10-6P	24
DMC1-2	18 cond, 9 stwpr	monitor Inverter, control	0.38	terminal block	inverter- loc B	MS3126F-14-19P	24
DC1-2	8 cond, shld	RS232 communication	0.23	9 pin D male	inverter - IO	25 pin D male	22
DM1-2	4 cond w/neu,gnd,shld	Inverter to motor	0.75	wired directly to disconnect.			10
DMB1-2	4 cond w/neu,gnd,shld	motor brake cable	0.50	lugs on rectifier	motor - loc B	AAP1452G3	16

Table 2

	description	function	dia	connector, from	route description	connector, to	AWG
AMD1	2 cond	motor1 drive cable	0.58	APP1452G3	mtr - loc B drv	APP1453G3	10
AMD2	2 cond	motor2 drive cable	0.58	APP1452G3	combined AMD1-2	part of AMD1	
	6 stwpr (by vendor)	encoder signal, +5	-	molded	enc - el, pier top	22856103	
AE1-2	6 stwpr (purchase)	EXE650	-	22856114 Conni	el - loc B intrf	MS3126F-12-10P	
AL	10 cond, 5 stwpr	limit switch	0..35	MS3126F-14-19S	cone - loc B intrf	MS3126F-14-19P	24
AI	6 cond, shld	index Magnesensor	0.23	MS3126F-12-10S	Az dsk - loc B intrf	MS3126F-12-10P	24
AT	6 cond, 3 stwpr	tachometer signal	0.28	MS3126F-12-10S	Az dsk - loc B intrf	MS3126F-12-10P	24
A-EBS	6 cond, 3 stwpr	brake solenoid control(2)	0.28	MS3126F-12-10S	pier - loc B intrf	MS3126F-12-10P	24
AP1-etc	10 cond, shld	DCpwr, +15v, +5v, +12v	0.72		various, as needed		16

Table 3

	description	function	dia	connector, from	route description	connector, to	AWG
PT	9 cond, 1 stwpr, 7 pwr	RS485 for temp control	0.28	MS3126J-12-10S	PM to loc B,sp cab	MS3126F-12-10P	24
PR	9 cond, 1 stwpr, 7 pwr	RS485 for temp control	0.28	MS3126J-12-10S	Radiator to loc B	MS3126F-12-10P	24
PC	18 cond, 9 stwpr	RS485 PM comm	0.38	MS3126J-14-19S	PM to loc B	MS3126F-14-19P	24
PP	12 cond, shld	DC power for primary	0.75	G6A18-22-SNE	PM to loc B	G6A18-22-PNE	16

Table 4

	description	function	dia	connector, from	route description	connector, to	AWG
I/SC1-5	8 cond, 4 twpr	camera control	0.28	MS3126J-12-10S	IAS/SI - loc A/B	MS3126F-12-10P	24
IC	18 cond, 9 stwpr	IAS control	0.38	MS3126J-14-19S	IAS - loc B	MS3126F-14-19P	24
IP	19 cond, shld	IAS DC power	0.75	G6A18-22-SNE	IAS - loc B	G6A18-22-PNE	16
I/SV1-6	RG58/RG59 coax	RS170, video	0.20	UG-89 B/U	IAS/SI - loc A/B	UG-89 B/U	20
SOF	6 path, optical fiber	data, command, comm	0.40	SMT	SI - loc A/B	SMT	
SP	19 cond, shld	general purpose, SI, pwr	0.75	G6A18-22-SNE	SI - loc A/B	G6A18-22-PNE	16
SC	18 cond, 9 stwpr	general purpose, SI, com	0.38	MS3126J-14-19S	SI - loc A/B	MS3126F-14-19P	24

Table 5

	description	function	dia	connector, from	route description	connector, to	AWG
HMX1	Belden T9418, 4 shld	X1 motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMX2	Belden T9418	X2 motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMY	Belden T9418	Y motor	0.25	757-7-OSN	Hydra - drvr/Skt	757-7-OPN	18
HMZ	7 cond, shld	Z motor	0.26	757-7-OSN	Hydra - cntrl/Skt	757-7-OPN	22
HRX1	vendor supplied	X1 resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HRX2	vendor supplied	X2 resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HRY	vendor supplied	Y resolver		757-7-OSN	Hydra - drvr/Skt	757-7-OPN	
HEX	2-2 stwpr	X encoder		757-12-OSN	Hydra - cntrl/Skt	DB-25P	22
HEY	2-2 stwpr	Y encoder		757-7-OSN	Hydra - cntrl/Skt	DB-25P	22
HSC	37 cond	stage control	0.43	757-37-OSN	Hydra - cntrl/Skt	757-37-OPN	24
HCC	7 cond, shld	camera control	0.26	757-12-OSN	Hydra - loc B	757-12-OPN	22
HLC	RG 58	LED control	0.2	KC59-128	Hydra - loc B	hard wired	20
HCV	RG 59	camera video	0.2	KC59-128	Hydra - loc B	KC59-128	20
HCLC	undefined	calibration lamp control			undefined		
HCLP	undefined	calibration lamp power			undefined		
HCM1-2	6 cond, 3 stwpr	RS232 communication	0.23	DB-25S	Hydra - loc B	757-7-OPN	22
HXD	vendor supplied	X drive		DB-25P	cntrl - drvr	DB-25P	
HYD	vendor supplied	Y drive		DB-25P	cntrl - drvr	DB-25P	
HICM	19 cond	com	0.32	DB-25P	cntrl - drvr	DB-25P	24

Table 6

	description	function	dia	connector, from	route description	connector, to	AWG
NMD1-2	2 cond	motor drive with tach	0.58	AAP1452G3	NIR - loc B drv	AAP1452G3	16
	6 stwpr (by vendor)	encoder signal, +5	0.30	molded	NIR - fork	22856103	
NE1-2	6 stwpr (purchase)	EXE650		22856114 Conni	fork - loc B intrf	MS3126F-12-10P	
NL1-2	6 cond, 3 stwpr	limit switch	0.25	MS3126J-12-10S	NIR - loc B intrf	MS3126F-12-10P	24
NI1-2	6 cond, shld	index Magnesensor	0.23	MS3126J-12-10S	fork- loc B intrf	MS3126F-12-10P	24
NBS1-2	10 cond, 5 stwpr	brake solenoid control	0.35	MS3126F-12-10S	skirt - loc B intrf	MS3126F-12-10P	24
NP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 7

	description	function	dia	connector, from	route description	connector, to	AWG
EMD1	2 cond	motor1 drive cable	0.58	AAP1452G3	El axis - loc B drv	AAP1453G3	10
EMD2	2 cond	motor2 drive cable	0.58	AAP1452G3	combined EMD1-2	part of EMD1	
	6 stwpr (by vendor)	encoder signal, +5	0.28	molded	El axis - fork	22856103	
EE	6 stwpr (purchase)	EXE650		22856114 Conni	fork - loc B intrf	MS3126F-12-10P	
EL	6 cond, 3 stwpr	limit switch	0.26	MS3126J-12-10S	drive sec- loc B intr	MS3126F-12-10P	24
EI	6 cond, shld	index Magnesensor	0.23	MS3126J-12-10S	El axis - loc B intrf	MS3126F-12-10P	24
ET	6 cond, 3 stwpr	tachometer signal	0.26	MS3126J-12-10S	El axis - loc B intrf	MS3126F-12-10P	24
EAS	10 cond, 5 stwpr	angle sensor(s)	0.35	MS3126J-10-6S	OSS - loc B intrf	MS3126F-10-6P	24
EP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 8

	description	function	dia	connector, from	route description	connector, to	AWG
O/TCom	9 cond, 1 stwpr, 7 pwr	RS485 comm to OSS	0.38	MS3126J-12-10S	OSS cntrlr to loc B	MS3126F-12-10P	24
OP	12 cond, shld	OSS power	0.75	G6A18-22-SNE	pwr, cntr sec to B	G6A18-22-PNE	16
OS	9 cond, 1 stwpr, 7 pwr	RS485 to secondary	0.28	MS3126J-12-10S	OSS, sp cable	MS3126F-12-10P	24
OTemp	9 cond, 1 stwpr, 7 pwr	RS485 to thermocoupler	0.28	MS3126J-12-10S	OSSCS	MS3126F-12-10P	24
OFFL	18 cond, 9 stwpr	flat field lamps + sensors	0.5	MS3126J-14-19S	OSS to ctrlr	MS3126J-14-19P	20
OCB1-2		counter balance control		MS3126J-12-10S	cb to ctrlr	MS3126J-12-10P	20
OMC1-2		mirror cover control		MS3126J-12-10S	mc to ctrlr	MS3126J-12-10P	20
TR	18 cond, 9 stwpr		0.38	MS3126J-14-19S	tertiary rot to ctrlr	MS3126J-14-19P	24
TF				MS3126J-12-10S	tertiary flip to ctrlr	MS3126J-12-10P	
T-SCtrl	18 cond, 9 stwpr		0.38	MS3126J-14-19S	solenoid pier - ctrlr	MS3126J-14-19P	24
SLC1-3	6 cond, 3 stwpr	load cell to preamp	0.23	MS3126J-10-6S	to sec'dary preamp	MS3126F-10-6P	24
SLC		load cell preamp to ctrlr		MS3126J-12-10S	sec'dary to ctrlr	MS3126J-12-10P	
TLC1-3	6 cond, 3 stwpr	load cell to preamp	0.23	MS3126J-10-6S	to tertiary preamp	MS3126F-10-6P	24
TLC		load cell preamp to ctrlr		MS3126J-12-10S	tertiary to ctrlr	MS3126J-12-10P	
OCCM-F	18 cond, 9 stwpr	gen, mod&fold cass	0.38	MS3126J-14-19S	cntr sec to loc B	MS3126F-14-19P	24
OCPM-F	12 cond, shld	gen, mod&fold cass, pwr	0.75	G6A18-22-SNE	pwr, cntr sec to B	G6A18-22-PNE	16
O/TCtrl	6 cond, 3 stwpr	control cable	0.23	MS3126J-10-6S	cntr sec to loc B	MS3126F-10-6P	24

Table 9

	description	function	dia	connector, from	route description	connector, to	AWG
ACMB	3 cond, 20Amp	AC,mtn ckt 1, blowers	0.64	terminal strip	-	PM cell	12
ACMO	3 cond, 20Amp	AC,mtn ckt 2, OSS	0.64	terminal strip	-	OSS	12
ACMG	3 cond, 20Amp	AC,mtn ckt 3, general	0.64	terminal strip	3 outlets		12
ACU1SK	3 cond, 20Amp	AC,UP-2 ckt 13, skirt	0.64	terminal strip	up13,210	Hydra & MOS	12
ACU1W	3 cond, 20Amp	AC,UP-2 ckt 15, WIYN	0.64	terminal strip	up15,1000	WIYN Port	12
ACU1O	3 cond, 20Amp	AC,UP-2 ckt 17, OSS	0.64	terminal strip	up17,1050	OSS	12
ACU2H	3 cond, 20Amp	AC,UP-2 ckt 8,HydraDr	0.69	terminal strip	skirt	Hydra drive	10

Table 10

Appendix B

InterOffice Memo

To: Distribution

From: John Little, Dan Blanco

Subject: Cable Runs to the Primary Mirror Cell

Date: September 24, 1992

CC: Larry Daggart, Dave Dryden, Larry Goble, Bob Harris, Matt Johns, Gerald Duffek

The intended design for cable and utility access to the primary mirror cell is shown in the accompanying sketches. A cable chain is used to control cable and hose direction and bend radius. Electrical connections and utility disconnects will be made at the mirror cell outer wall. Utility and cables will be run through a cable trough down along the fork tine and through a grommet near the base of the tine, into the fork assembly, through the azimuth bearings and then into a cable tray to the second floor control location for electrical cables and the mechanical room for utilities.

The choice location for utilities and cable routing to the mirror cell is from near the top of the fork tine to the top side of the elevation drive sector as viewed from the back of the cell (see sketch). These locations allow the minimum cable length and least interference to the friction drive mechanisms.

The cable chain is supported on the OSS at the elevation drive sector location by a support arm with built in strain relief and room for a service loop.

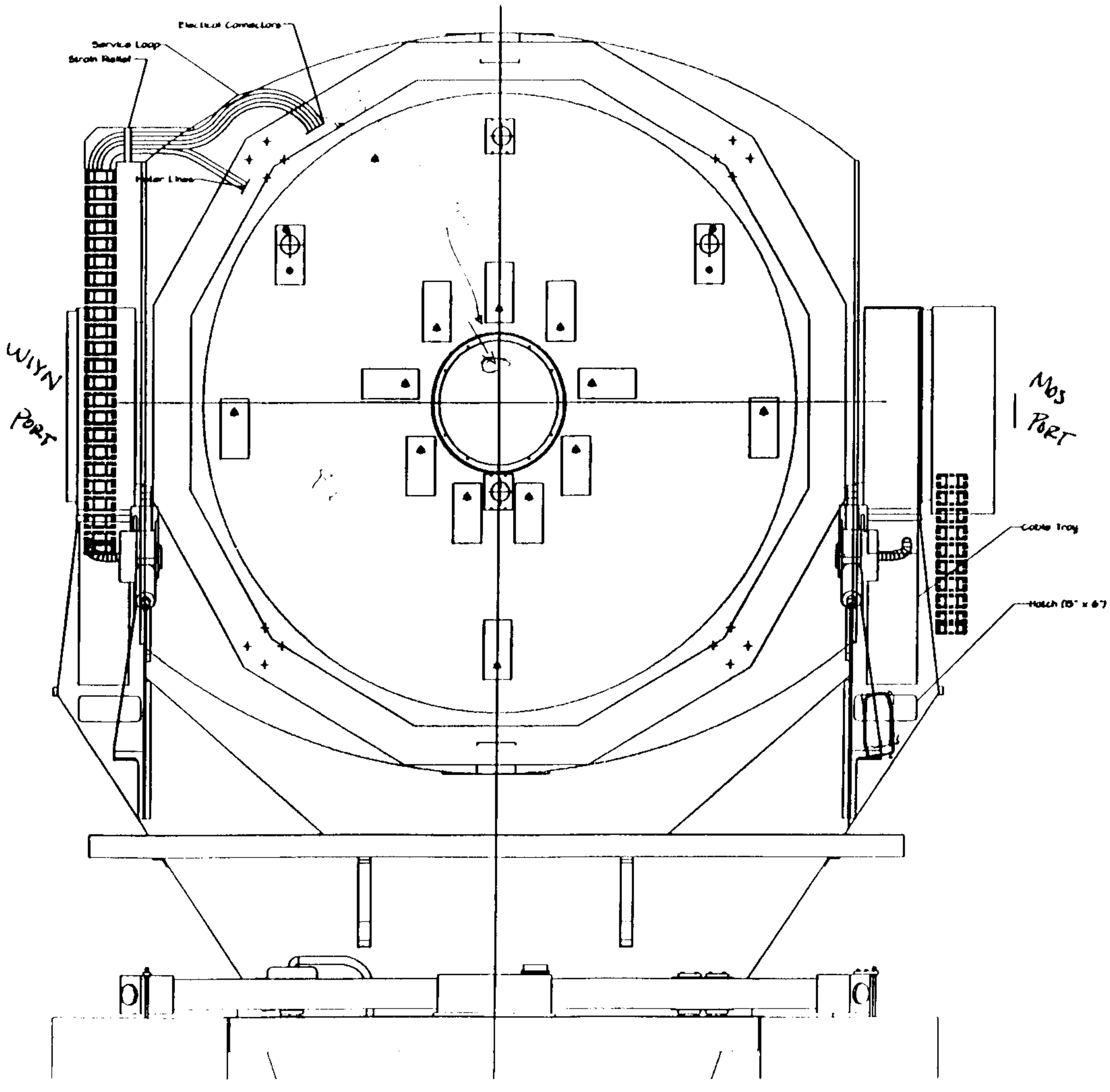
Primary mirror cell location for utilities, power, and controls is located in the top left facet of the cell as viewed from the back and shown in the attached sketch. It is our intention to install symmetric cable trays and feed throughs on both fork tines, thus either the right or the left top facet is acceptable for cable and utility interfaces. Only one side should be used to carry cables and utilities to the OSS and mirror cell. It is expected that there will be three separate distribution panels on the mirror cell allowing mirror cell removal without having cables dangling. The first distributes AC power to the OSS, center section, and mirror cell blowers. A small control cable connects from the AC panel to the control distribution panel providing control of the mirror blowers. The control distribution panel will provide control of the blower power, primary mirror actuators and communication to the OSS, tertiary, and secondary functions. Utilities will be on another adjacent panel with quick disconnect fittings where possible.

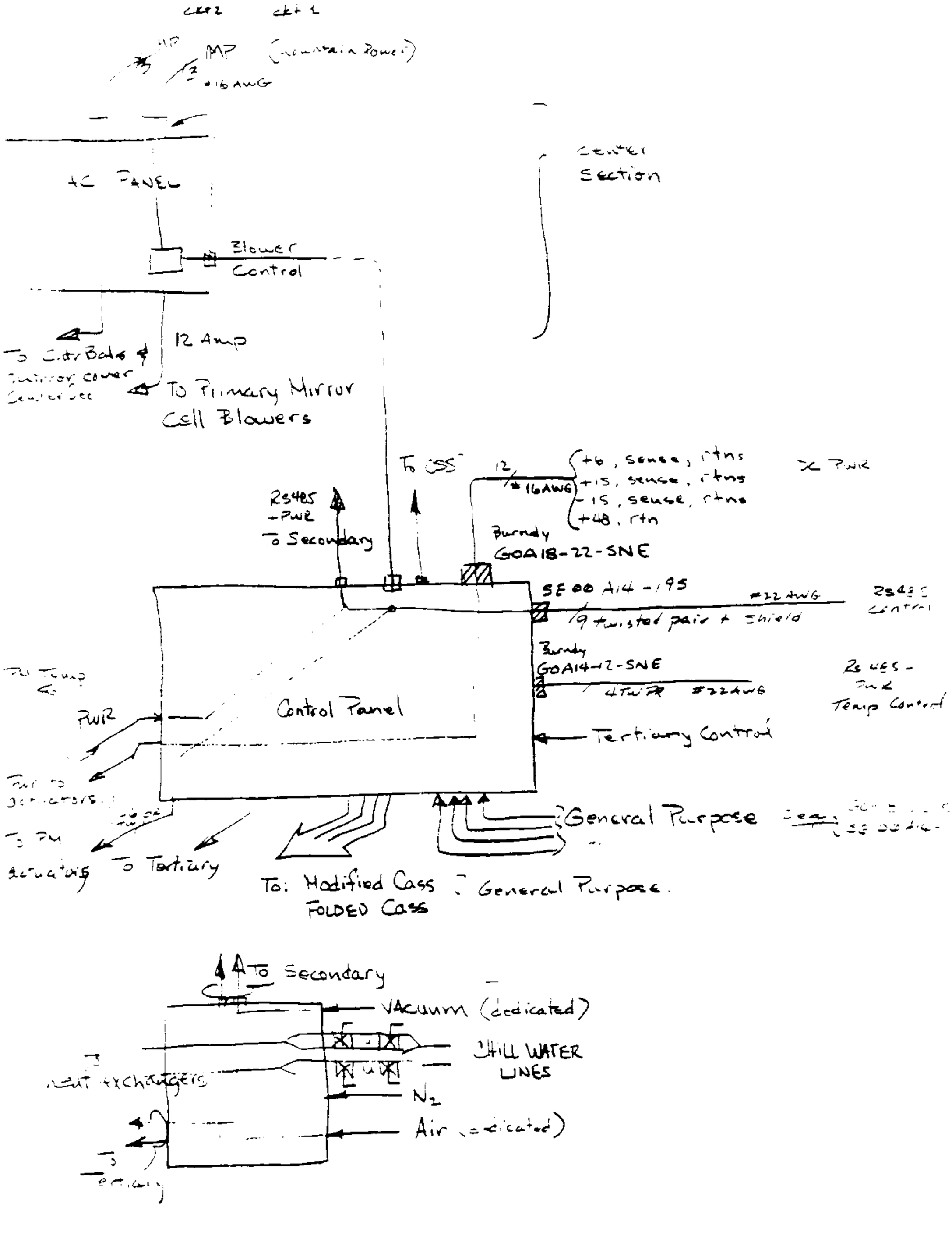
A sketch is attached that shows the interface connections across the elevation bearing, including AC power, control connections, and utilities. A list of cell utilities and cables follows:

No.	description	function	bend radius	connector
2	1 1/2" O.D. hose	chill water	7 1/2"	1" I.D. union
1	1/2" O.D. hose	N2 gas for instrument use	4"	quick disconnect
1	1/2" O.D. hose	vacuum for secondary & tertiary	4"	quick disconnect
1	1/2" O.D. hose	compressed air for secondary & tertiary	4"	quick disconnect
1	12 #16AWG	DC power cable for primary	4"	GOA18-22-SNE
1	18, 9 twpr #22AWG	RS485 communication cable	4"	SE00A14-19S
1	9, 2 twpr #22AWG	RS485 + power for temp control	2"	MS3120F-12-10S
1	12 #16AWG	tertiary control	4"	

2	12 #16AWG	general purpose, modified & folded cassegrain positions	4"	GOA18-22-SNE
2	18, 9 twpr #22AWG	general purpose, modified & folded cassegrain positions	4"	SE00A14-19S
2	3 #16AWG	AC power for blowers and OSS	2"	
1	4, 2twpr #22AWG	blower control cable	2"	included in temp control

If it becomes necessary due to expansion of the telescope capabilities, ie straight cassegrain option, it is possible to mount a similar cable chain on the other tine.


Electrical Connections
Service Loop
Strain Relief
Water Lines
WIYN PORT
MOS PORT
Cable Tray
Hatch (15" x 6')


ckt 2
ckt 1
HP
MP
(Mountain Power)
#16 AWG
AC Panel
Blower Control
12 Amp
To Ctr Bdg & Primary Cover Heaters
To Primary Mirror Cell Blowers
To CSS
12/ #16AWG
+6, sense, rtns
+15, sense, rtns
-15, sense, rtns
+48, rtn
X PWR
RS485 -PWR To Secondary
Burndy GOA18-22-SNE
SE 00 A14-195
#22 AWG 9 twisted pair + Shield
Burndy GOA14-2-SNE
4 twisted pair #22AWG
Control Panel
PWR
Tertiary Control
To Secondary
VACUUM (dedicated)
UTILL WATER LINES
N_2
Air (dedicated)
To: Modified Cass
FOLDED Cass
General Purpose