Title: Telescope Cabling for the WIYN 3.5 Meter Telescope

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Telescope Cabling

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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 three power sources; UPS-1, UPS-2, 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 drive motors, power supplies, amplifiers, and test instruments used in controlling the telescope. 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 VT130G2U2035 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 VT130G2-OPTB, driving 5 horsepower AC induction gear motors. Communication with the TCS is through an RS232 link provided by the multioption board. A manual controller will exist that will allow manual control of the dome rotation. A failsafe 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 sensor that controls air release. The multiturn encoder is a BEI part number MT40D-X-HSS8192N-128T-X-D2-CR-S-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	PT06E-14-19S	encoder - loc B	MS3126F-14-19P	24
DBS	4 cond shld	brake solenoid control	0.36	MS3126F-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

Table 2

Cable DE: The cable connector for the BEI encoder, PT06E-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'
DB	to	interface chassis conn	
socket	plug	grouping	description/comments
A	A		bit 0, LSB
B	B		bit 1
C	C		bit 2
D	D		bit 3
E	E		bit 4
F	F		bit 5
G	G		bit 6
H	H		bit 7
J	J		bit 8
K	K		bit 9
L	L		bit 10
M	M		bit 11
N	N		bit 12
P	P		bit 13, MSB
...		TBD	depends on enc selected **
h	R	TBD	data ready output
j	S	TBD	case ground
m	T	TBD	power ground
n	U	TBD	direction select input signal
p	V	TBD	data hold input
s		TBD	+ 5 volts DC input

Table 2.1

Cable DBS: The MS3126F-10-6S connector is connected to the brake solenoid and pressure sensor 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 sensor 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		solenoid control
B	B		solenoid return
C	C		
D	D		air pressure sensor
E	E		sensor return
F	F		

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	FLA	fault signal input
B	B	FLB	fault signal output
C	C	FLC	fault signal return
D	D	FM	frequency signal output
E	E	AM	current signal output
F	F	CC	monitor returns
G	G	P24	+24vdc fctn 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 - TXD
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 a target magnet on the drive disk used for an accurate home position. Limit switches are located on the telescope cone indicating rough azimuth position and rotation limits. A lanyard switch provides the hard limit indication and initiates an emergency stop. If an overspeed condition is sensed by the independent tachometer, an emergency stop is initiated.

A Copley model 664 power supply and two Copley model 220 amplifiers reside on top of the pier with the motors. Conditioning electronics for the Sony sensor and Heidenhain encoders also reside on top of the pier. All control signals originate from a motion controller residing on the TCS backplane. Failsafe 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 opens an orifice and dumps air pressure quickly allowing both elevation and azimuth brakes to engage. Under other than emergency conditions, for example during observatory shutdown, the air is bled off slowly. Two separate solenoid release valves are necessary to accomplish stepped air pressure release. Location of the two solenoid release valves 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
AMC1-2	14 cond, 7 stwpr	analog motor control	0.30	15 socket D subm	amp - loc B intrf	MS3126F-14-19P	24
AMD1-2	8 cond	motor drive cable	0.58	G0A14-92-SNE	mtr - amp, pier top	screw terminal 1J7	16
AAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp - pwr,pier top	G0A14-92-PNE	16
	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-12-10S	cone - loc B intrf	MS3126F-12-10P	24
AI	4 cond, shld	index Magnesensor	0.23	solder lug	Az dsk - loc B intrf	MS3126F-10-6P	24
AT	6 cond, 3 stwpr	tachometer signal	0.28	MS3126F-10-6S	Az dsk - loc B intrf	MS3126F-10-6P	24
A-EBS	6 cond, 3 stwpr	brake solenoid control(2)	0.28	MS3126F-10-6S	pier - loc B intrf	MS3126F-10-6P	24
AP1-etc	10 cond, shld	DCpwr, +15v, +5v, +12v	0.72		various, as needed		16

Table 3

Cable AMC1-2: The 15 socket D subminiature connector is connected to the input 1P1 connector of the Copley amplifier on top of the pier. The cable is routed from the amplifier and connected with a

MS3126F-14-19P connector to the CS interface chassis at location B. Table 3.1 defines the pin assignments for the two azimuth motor control, analog drive signal cables.

from	Copley amplifier input		length= 2@~30'
AMC1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
	A		
	B		
	C		
	D		
1	E		signal ground input #1
2	F		inv. command input #1
3	G		noninv. tach FB input #2
4	H		inv. auxilliary input #3
5	J		S2 inhibit +5
6	K		S2 inhibit -return
7	L		S3 inhibit to signal ground
8	M		signal ground input #2
9	N		noninv. command input #1
10	P		inv. tach FB input #2
11	R		noninv. auxilliary input #3
12	S		noninv. high Z input #4
13	T		remote operation LED+
14	U		remote operation LED-
15	V		shield

Table 3.1

Cable AMD1-2: The two G0A14-92-SNE 12 position connectors are connected to the drive motors at their locations on the top of the pier. The other end of these cables are connected to the 1J7 screw terminals on the amplifiers located on top of the pier next to the motors. Table 3.2 defines the pin assignments for two azimuth motor drive cables.

from	Az motors 1 & 2		length= 2@~3'
AMD1-2	to	Az amplifiers 1 & 2 on top of pier 1J7	
socket	terminal	grouping	description/comments
A	6	1	
B	6	1	out +
C	6	1	
D			
E	7	2	
F	7	2	out -
G	7	2	
H			
J	5	3	HV gnd
K			
L	5	3	HV gnd
M			

Table 3.2

Cable AAP1-2: These cables connect the two 1J7 seven position terminal strips on the two drive amplifiers to the high voltage power supply on top of the pier with a G0A14-92-PNE connector. Table 3.3 defines the pin assignments for the two azimuth amplifier power cables.

from	amplifier1 & 2		length= 2@~10'
AAP1-2	to	power supply on top of pier	
terminal	plug	grouping	description/comments
4	A	1	
4	B	1	+high voltage (40vdc)
4	C	1	15 Amp fuse on amplifier
	D		
5	E	2	
5	F	2	-high voltage (40vdc)
5	G	2	
	H		
5	J	3	gnd
	K		
5	L	3	gnd
	M		

Table 3.3

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 3.4 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 In1	A
2	2	yellow	-signal In1	B
3	3	brown	+5vdc	C
4	4	white	0vdc	D
5	5	blue	+signal In2	E
6	6	red	-signal In2	F
7	7	grey	+signal In0	G
8	8	pink	-signal In0	H
9	9		shield	J
				K

Table 3.4

Cable AL: The MS3126F-12-10S 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-12-10P connector to the CS interface chassis at location B. Table 3.5 defines the pin assignments for the azimuth limit switch cable.

from	limit sw's on conn	length= ~30'	
AL	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		spare
B	B		spare
C	C		lanyard, hard limit
D	D		lanyard return
E	E		right rotation limit
F	F		right rtn
G	G		left rotation limit
H	H		left rtn
J	J		center position switch
K	K		center rtn

Table 3.5

Cable AI: The cable coming from the Sony B3 Magnesensor is connected to the detector electronics on the top of the pier. The cable is routed from the detector electronics and connected with a MS3126F-10-6P connector to the CS interface chassis at location B. Table 3.6 defines the pin assignments for the azimuth index Magnesensor cable.

from	index sensor	length= ~30'	
AI	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		red
B	B		black
C	C		white
D	D		gnd
E	E		
F	F		

Table 3.6

Cable AT: The cable with a MS3126F-10-6S 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-10-6P connector to the CS interface chassis at location B. Table 3.7 defines the pin assignments for the azimuth tachometer cable.

from	tachometer, Ax axis		length= ~30'
AT	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		
B	B		TBD
C	C		
D	D		
E	E		
F	F		

Table 3.7

Cable A-EBS: The MS3126F-10-6S connector is connected to the two brake solenoids 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 solenoids and sensor to the CS interface chassis and connected with a MS3126F-10-6P connector. An air pressure intensifier mounted in the pier feeds the high pressure air lines through solenoid valves and pressure sensor which are then routed to the two sets of brakes on both the elevation and azimuth axes. Table 3.8 defines the pin assignments for the azimuth and elevation brake solenoid control cable.

from	brake solenoids		length= 1@~30'
A-EBS	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		pressure sensor
B	B		pressure sensor return
C	C		fast release off
D	D		rtn
E	E		slow release off
F	F		rtn

Table 3.8

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	MS3126F-12-10S	PM to loc B,sp cab	MS3126F-12-10P	24
PC	18 cond, 9 stwpr	RS485 PM comm	0.38	MS3126F-14-19S	PM to loc B	MS3126F-14-19P	24
PS	9 cond, 1 stwpr, 7 pwr	RS485 to secondary	0.28	MS3126F-12-10S	OSS,sp cable	MS3126F-12-10P	24
PP	12 cond, shld	DC power for primary	0.75	G0A18-22-SNE	PM to loc B	G0A18-2-PNE	16

Table 4

Cable PT: The MS3126F-12-10S connector is connected to the primary mirror cell interface box. The cables come across the elevation wrap, through the mayploe, 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, top	
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		+48vdc
K	K		+48 return

Table 4.1

Cable PC: The MS3126F-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= ~30'
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 4.2

Cable PS: The MS3126F-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 on to the PM cell. Connection is made with a MS3126F-12-10P connector to the primary mirror cell interface box. Table 4.3 defines the pin assignments for the primary to secondary cable.

from	Secondary M cell		length= ~28'
PS	to	PM interface box, secondary control	
socket	plug	grouping	description/comments
A	A		+ RS485 signal
B	B		- RS485 signal
C	C		shield
D	D		+15vdc
E	E		-15vdc
F	P		±15v return
G	G		+8vdc
H	H		+8 return
J	J		+48vdc
K	K		+48 return

Table 4.3

Cable PP: The G0A18-22-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 G0A18-22-PNE connector to the primary mirror power supply. Table 4.4 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/SC1-4	8 cond, 4 twpr	camera control	0.28	MS3126F-12-10S	IAS/SI - loc A/B	MS3126F-12-10P	24
IC	18 cond, 9 stwpr	IAS control	0.38	MS3126F-14-19S	IAS - loc B	MS3126F-14-19P	24
IP	19 cond, shld	IAS DC power	0.75	G0A18-22-SNE	IAS - loc B	G0A18-22-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	G0A18-22-SNE	SI - loc A/B	G0A18-22-PNE	16
SC	18 cond, 9 stwpr	general purpose, SI, com	0.38	MS3126F-14-19S	SI - loc A/B	MS3126F-14-19P	24

Table 5

Cable I/SC1-4: The MS3126F-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/SC1-4	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 MS3126F-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 G0A18-22-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 G0A18-22-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 G0A18-22-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 G0A18-22-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 MS3126F-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 and two limit switches for reporting the end of allowable rotation in either direction. Electronics required to support the drives and position sensors will be located under the skirt or in the fork assembly as required by acceptable cable length. Electronics include a power amplifier for each NIR, a common power supply for both amplifiers and motors, a small Sony PD10 electronics interface box for the Magnesensors, and possibly a +5vdc, +12vdc, and ±15vdc power supplies. All control signals originate from a motion controller residing on the TCS backplane. Power for the drives comes from a separate UPS-2 circuit. Power for the control functions and logic power is shared with Hydra control power on a UPS-1 circuit.

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	8 cond	motor drive cable	0.58	G0A14-92-SNE	NIR - skirt	screw terminal 1J7	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	MS3126F-10-6S	NIR - loc B intrf	MS3126F-10-6P	24
	2 stwpr (by vendor)	index Magnesensor	0.23	molded	NIR - skirt	solder lug	
NI1-2	6 cond, 3 stwpr	index detector	0.25	solder lug	fork- loc B intrf	MS3126F-10-6P	24
NBS1-2	10 cond, 5 stwpr	brake solenoid control	0.35	MS3126F-12-10S	skirt - loc B intrf	MS3126F-12-10P	24
NMC1-2	14 cond, 7 stwpr	analog motor control	0.35	15 socket D subm	skirt - loc B intrf	MS3126F-14-19P	24
NAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp to pwr sply	G0A14-92-PNE	16
NP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 7

Cable NMD1-2: The two G0A14-92-SNE 12 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 the 1J7 screw terminals on the amplifiers located under the skirt. Table 7.1 defines the pin assignments for the two NIR motor drive cables.

from	NIR motor 1 & 2		length= 2@~20'
NMD1-2	to	NIR amplifier 1 & 2 under skirt 1J7	
socket	terminal	grouping	description/comments
A	6	1	
B	6	1	out +
C	6	1	
D			
E	7	2	
F	7	2	out -
G	7	2	
H			
J	5	3	HV gnd
K			
L	5	3	HV gnd
M			

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 Io0	G
8	8	pink	-signal Io0	H
9	9		shield	J
				K

Table 7.2

Cable NL1-2: The MS3126F-10-6S 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-10-6P 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= ~70'
NL1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		right rotation limit
B	B		right rtn
C	C		left rotation limit
D	D		left rtn
E	E		right/left of center switch
F	F		return

Table 7.3

Cable NI1-2: The cable coming from each Sony B3 Magnesensor, one for each NIR, is connected to its detector electronics under the skirt by solder lug. The detector cable is routed through the maypole, cable tray and connected with a MS3126F-10-6P 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, brake cntrl		length= ~70'
NI1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		A+, index sensor output,1
B	B		A-, index sensor output,1
C	C		+12vdc
D	D		-12vdc return
E	E		-12vdc return
F	F		shield

Table 7.4

Cable NBS1-2: The MS3126F-12-10S connectors are connected to the their brake solenoids 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 solenoids 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 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@~30'
NBS1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		pressure sensor
B	B		pressure sensor return
C	C		rtn
D	D		rtn
E	E		WIYN brake cntrl, fast
F	F		WIYN brake cntrl, slow
G	G		WIYN return
H	H		MOS brake cntrl, fast
J	J		MOS brake cntrl, slow
K	K		MOS return

Table 7.5

Cable NMC1-2: The 15 pin socket D subminiature connectors are connected to the input 1P1 connector of the Copley amplifiers under the skirt. The cable is routed through the maypole, cable tray and connected with a MS3126F-14-19P connector to the CS interface chassis. Table 7.6 defines the pin assignments for the two NIR motor control analog drive signal cables.

from	NIR amplifier, skirt		length= 2@~6'
NMC1-2	to	NIR conditioning electronics, skirt	
socket	plug	grouping	description/comments
	A		
	B		
	C		
	D		
1	E		signal ground input #1
2	F		inv. command input #1
3	G		noninv. tach FB input #2
4	H		inv. auxilliary input #3
5	J		S2 inhibit +5
6	K		S2 inhibit -return
7	L		S3 inhibit to signal ground
8	M		signal ground input #2
9	N		noninv. command input #1
10	P		inv. tach FB input #2
11	R		noninv. auxilliary input #3
12	S		noninv. high Z input #4
13	T		remote operation LED+
14	U		remote operation LED-
15	V		shield

Table 7.6

Cable NAP1-2: These cables connect the 1J7 power terminal connections on the two NIR drive amplifiers with the G0A14-92-PNE connectors to the high voltage power supply under the skirt. Table 7.7 defines the pin assignments for the two NIR amplifier power cables.

from	amplifier1 & 2, skirt		length= 2@~5'
NAP1-2	to	power supply under skirt	
terminal	plug	grouping	description/comments
4	A	1	
4	B	1	+high voltage (40vdc)
4	C	1	15 Amp fuse on amplifier
	D		
5	E	2	
5	F	2	-high voltage (40vdc)
5	G	2	
	H		
5	J	3	gnd
	K		
5	L	3	gnd
	M		

Table 7.7

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. A Copley 664 power supply and two Copley 220 amplifiers reside under the skirt. 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. Failsafe 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. Under normal use, during observatory shutdown, the air is bled off slowly. To accomplish stepped air pressure release two separate release valves are necessary. The location of the solenoid release valves will be 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	8 cond	motor drive cable	0.58	G0A14-92-SNE	El axis - amp,skirt	screw terminal 1J7	16
	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	MS3126F-10-6S	drive sec- loc B intr	MS3126F-10-6P	24
EI	4 cond, 2 stwpr	index Magnesensor	0.23	solder lug	El axis - loc B intrf	MS3126F-10-6P	24
ET	6 cond, 3 stwpr	tachometer signal	0.26	MS3126F-10-6S	El axis - loc B intrf	MS3126F-10-6P	24
EAS	10 cond, 5 stwpr	angle sensor(s)	0.35	8 pin modular	OSS - loc B intrf	MS3126F-12-10P	24
EMC1-2	14 cond, 7 stwpr	analog motor control	0.35	15 socket D subm	amp - loc B intrf	MS3126F-14-19P	24
EAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp to pwr sply	G0A14-92-PNE	16
EP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 8

Cable EMD1-2: The two G0A14-92-SNE 12 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 the 1J7 screw terminals on the amplifiers located under the skirt. Table 8.1 defines the pin assignments for the two elevation motor drive cables.

from	El motor 1 & 2		length= 2@~20'
EMD1-2	to	El amplifier 1 & 2 under skirt 1J7	
socket	terminal	grouping	description/comments
A	6	1	
B	6	1	out +
C	6	1	
D			
E	7	2	
F	7	2	out -
G	7	2	
H			
J	5	3	HV gnd
K			
L	5	3	HV gnd
M			

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 ls1	A
2	2	yellow	-signal ls1	B
3	3	brown	+5vdc	C
4	4	white	0vdc	D
5	5	blue	+signal ls2	E
6	6	red	-signal ls2	F
7	7	gray	+signal ls0	G
8	8	pink	-signal ls0	H
9	9		shield	J
				K

Table 8.2

Cable EL: The MS3126F-10-6S connector is connected to the limit switch at its location on the fork tine. The cable is routed through the fork tine, maypole, cable tray, and connected with a MS3126F-10-6P connector to the CS interface chassis at location B. Table 8.3 identifies the pin assignments for the elevation limit switch cable.

from	EI limit sw, drv sectr		length= ~60'
EL	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		up rotation limit, hard
B	B		up rotation limit, soft
C	C		up rtn
D	D		down rotation limit, hard
E	E		down rotation limit, soft
F	F		down rtn

Table 8.3

Cable EI: The cable coming from the Sony B3 Magnesensor is connected to its detector electronics in the fork by solder lug. The cable is routed from the detector solder lugs, through the fork, maypole, cable tray, and connected with a MS3126F-10-6P 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= ~60'
EI	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
A	A		red
B	B		black
C	C		white
D	D		grod
E	E		
F	F		

Table 8.4

Cable ET: The cable with a MS3126F-10-6S 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-10-6P 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		
B	B		TBD
C	C		
D	D		
E	E		
F	F		

Table 8.5

Cable EAS: The cable with an eight pin modular connector is connected to the angle sensor(s) located on the OSS or center section. The cable is routed from the angle sensor(s), 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. (Connector shown is for a Lucas Accustar Clinometer.)

from	angle sensor(s), OSS		length= ~85'
EAS	to	CS interface chassis at loc B	
plug	plug	grouping	description/comments
1	A	TBD	signal gnd
2	B	TBD	signal output
5	C	TBD	-12 vdc
6	D	TBD	+12 vdc
7	E	TBD	shield
8	F	TBD	gnd
	G	TBD	
	H	TBD	
	J	TBD	
	K	TBD	

Table 8.6

Cable EMC1-2: The 15 pin socket D subminiature connectors are connected to the input 1P1 connector of the Copley amplifiers under the skirt. The cable is routed from the amplifier, through the maypole and cable tray, and connected with a MS3126F-14-19P connector to the CS interface chassis at location B. Table 8.7 defines the pin assignments for the elevation motor control cable.

from	Copley amplifier input		length= 20'-50'
EMC1-2	to	CS interface chassis at loc B	
socket	plug	grouping	description/comments
	A		
	B		
	C		
	D		
1	E		signal ground input #1
2	F		inv. command input #1
3	G		noninv. tach FB input #2
4	H		inv. auxilliary input #3
5	J		S2 inhibit +5
6	K		S2 inhibit -return
7	L		S3 inhibit to signal ground
8	M		signal ground input #2
9	N		noninv. command input #1
10	P		inv. tach FB input #2
11	R		noninv. auxilliary input #3
12	S		noninv. high Z input #4
13	T		remote operation LED+
14	U		remote operation LED-
15	V		shield

Table 8.7

Cable EAP1-2: These cables connect the two 1J7 power terminal connections on the two elevation drive amplifiers with the G0A14-92-PNE connectors to the high voltage power supply under the skirt. Table 8.8 defines the pin assignments for the two elevation amplifier power cables.

from	amplifier1 & 2, skirt		length= 20'--5'
EAP1-2	to	power supply under skirt	
terminal	plug	grouping	description/comments
4	A	1	
4	B	1	+high voltage (40vdc)
4	C	1	15 Amp fuse on amplifier
	D		
5	E	2	
5	F	2	-high voltage (40vdc)
5	G	2	
	H		
5	J	3	gnd
	K		
5	L	3	gnd
	M		

Table 8.8

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; the method of implementation is being decided. It is probable that a low power CPU will reside on the OSS to control temperature information gathering, mirror cover opening and closing, counter balance position, and tertiary motion. The expected communication link is RS485.

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.

	description	function	dia	connector, from	route description	connector, to	AWG
O/TCom	18 cond, 9 stwpr	RS485 comm to OSS	0.38	MS3126F-14-19S	OSS cntrlr to loc B	MS3126F-14-19P	24
OP	12 cond, shld	OSS power	0.75	G0A18-22-SNE	pwr, cntr sec to B	G0A18-22-PNE	16
OCCM-F	18 cond, 9 stwpr	gen, mod&fold cass	0.38	MS3126F-14-19S	cntr sec to loc B	MS3126F-14-19P	24
OCPM-F	12 cond, shld	gen, mod&fold cass, pwr	0.75	G0A18-22-SNE	pwr, cntr sec to B	G0A18-22-PNE	16
O/TCtrl	6 cond, 3 stwpr	control cable	0.23	MS3126F-10-6S	cntr sec to loc B	MS3126F-10-6P	24

Table 9

Cable O/TCom: The MS3126F-14-19S 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-14-19P connector to the CS interface chassis. Table 9.1 defines the pin assignments for the OSS/Tertiary communications cable.

from	OSS controller		length= ~80'
O/TCom	to	CS interface chassis, loc B	
socket	plug	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
V	V		TBD

Table 9.1

Cable OP: The G0A18-22-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 G0A18-22-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 OCCM-F: The MS3126F-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 9.3 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 9.3

Cable OCPM-F: The G0A18-22-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 G0A18-22-PNE connector to the cassegrain power supply. Table 9.4 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	grouping	description/comments
A	A		shield
B	B		TBD
-	-		-
-	-		-
-	-		-
Y	Y		TBD

Table 9.4

Cable O/TCtrl: TBD.

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

Table 9.5

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,UPS-1 ckt 1, skirt	0.64	terminal strip	up13,210	Hydra control	12
	3 cond, 20Amp	AC,UPS-1 ckt 1, Hydra	0.64	terminal strip	up13	MOS Port	12
ACU1W	3 cond, 20Amp	AC,UPS-1 ckt 2, WIYN	0.64	terminal strip	up17,1000	WIYN Port	12
ACU1O	3 cond, 20Amp	AC,UPS-1 ckt 3, OSS	0.64	terminal strip	up15,1050	OSS	12
ACU2E	3 cond, 20Amp	AC,UPS-2 ckt 1, El Dr	0.69	terminal strip	skirt	Elevation drive	10
ACU2N	3 cond, 20Amp	AC,UPS-2 ckt 2, NIR Dr	0.69	terminal strip	skirt	NIR drives	10
ACU2H	3 cond, 20Amp	AC,UPS-2 ckt 3,HydraDr	0.69	terminal strip	skirt	Hydra drive	10
ACU2A	3 cond, 20Amp	AC,UPS-2 ckt 4, Az Dr	0.69	terminal strip	top o f pier	Az drive	10

Table 10

Dome

	description	function	dia	connector, from	route description	connector, to	AWG
DE	18 cond,+5,gnd, shld	absolute encoder cable	0.38	PT06E-14-19S	encoder - loc B	MS3126F-14-19P	24
DBS	4 cond shld	brake solenoid control	0.36	MS3126F-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

Table 2

Azimuth Axis Drive

	description	function	dia	connector, from	route description	connector, to	AWG
AMC1-2	14 cond, 7 stwpr	analog motor control	0.30	15 socket D subm	amp - loc B intrf	MS3126F-14-19P	24
AMD1-2	8 cond	motor drive cable	0.58	G0A14-92-SNE	mtr - amp, pier top	screw terminal 1J7	16
AAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp - pwr,pier top	G0A14-92-PNE	16
	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-12-10S	cone - loc B intrf	MS3126F-12-10P	24
AI	4 cond, shld	index Magnesensor	0.23	solder lug	Az dsk - loc B intrf	MS3126F-10-6P	24
AT	6 cond, 3 stwpr	tachometer signal	0.28	MS3126F-10-6S	Az dsk - loc B intrf	MS3126F-10-6P	24
A-EBS	6 cond, 3 stwpr	brake solenoid control(2)	0.28	MS3126F-10-6S	pier - loc B intrf	MS3126F-10-6P	24
AP1-etc	10 cond, shld	DCpwr, +15v, +5v, +12v	0.72		various, as needed		16

Table 3

Primary Mirror Subsystem

	description	function	dia	connector, from	route description	connector, to	AWG
PT	9 cond, 1 stwpr, 7 pwr	RS485 for temp control	0.28	MS3126F-12-10S	PM to loc B,sp cab	MS3126F-12-10P	24
PC	18 cond, 9 stwpr	RS485 PM comm	0.38	MS3126F-14-19S	PM to loc B	MS3126F-14-19P	24
PS	9 cond, 1 stwpr, 7 pwr	RS485 to secondary	0.28	MS3126F-12-10S	OSS,sp cable	MS3126F-12-10P	24
PP	12 cond, shld	DC power for primary	0.75	G0A18-22-SNE	PM to loc B	G0A18-2-PNE	16

Table 4

WIYN Port, SI and IAS

	description	function	dia	connector, from	route description	connector, to	AWG
I/SC1-4	8 cond, 4 twpr	camera control	0.28	MS3126F-12-10S	IAS/SI - loc A/B	MS3126F-12-10P	24
IC	18 cond, 9 stwpr	IAS control	0.38	MS3126F-14-19S	IAS - loc B	MS3126F-14-19P	24
IP	19 cond, shld	IAS DC power	0.75	G0A18-22-SNE	IAS - loc B	G0A18-22-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	G0A18-22-SNE	SI - loc A/B	G0A18-22-PNE	16
SC	18 cond, 9 stwpr	general purpose, SI, com	0.38	MS3126F-14-19S	SI - loc A/B	MS3126F-14-19P	24

Table 5

Hydra

	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

MOS and WTYN Port NIRs

	description	function	dia	connector, from	route description	connector, to	AWG
NMD1-2	8 cond	motor drive cable	0.58	G0A14-92-SNE	NIR - skirt	screw terminal 1J7	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	MS3126F-10-6S	NIR - loc B intrf	MS3126F-10-6P	24
	2 stwpr (by vendor)	index Magnesensor	0.23	molded	NIR - skirt	solder lug	
NI1-2	6 cond, 3 stwpr	index detector	0.25	solder lug	fork- loc B intrf	MS3126F-10-6P	24
NBS1-2	10 cond, 5 stwpr	brake solenoid control	0.35	MS3126F-12-10S	skirt - loc B intrf	MS3126F-12-10P	24
NMC1-2	14 cond, 7 stwpr	analog motor control	0.35	15 socket D subm	skirt - loc B intrf	MS3126F-14-19P	24
NAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp to pwr sply	G0A14-92-PNE	16
NP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 7

Elevation Axis Drive

	description	function	dia	connector, from	route description	connector, to	AWG
EMD1-2	8 cond	motor drive cable	0.58	G0A14-92-SNE	El axis - amp,skirt	screw terminal 1J7	16
	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	MS3126F-10-6S	drive sec- loc B intr	MS3126F-10-6P	24
EI	4 cond, 2 stwpr	index Magnesensor	0.23	solder lug	El axis - loc B intrf	MS3126F-10-6P	24
ET	6 cond, 3 stwpr	tachometer signal	0.26	MS3126F-10-6S	El axis - loc B intrf	MS3126F-10-6P	24
EAS	10 cond, 5 stwpr	angle sensor(s)	0.35	8 pin modular	OSS - loc B intrf	MS3126F-12-10P	24
EMC1-2	14 cond, 7 stwpr	analog motor control	0.35	15 socket D subm	amp - loc B intrf	MS3126F-14-19P	24
EAP1-2	8 cond	amplifier power cable	0.58	screw terminal 1J7	amp to pwr sply	G0A14-92-PNE	16
EP1,etc	10 cond, shld	DCpwr,+15v,+5v, +12v	0.72		various, as needed		16

Table 8

OSS Control Subsystem

	description	function	dia	connector, from	route description	connector, to	AWG
O/TCom	18 cond, 9 stwpr	RS485 comm to OSS	0.38	MS3126F-14-19S	OSS cntrlr to loc B	MS3126F-14-19P	24
OP	12 cond, shld	OSS power	0.75	G0A18-22-SNE	pwr, cntr sec to B	G0A18-22-PNE	16
OCCM-F	18 cond, 9 stwpr	gen, mod&fold cass	0.38	MS3126F-14-19S	cntr sec to loc B	MS3126F-14-19P	24
OCPM-F	12 cond, shld	gen, mod&fold cass, pwr	0.75	G0A18-22-SNE	pwr, cntr sec to B	G0A18-22-PNE	16
O/TCtrl	6 cond, 3 stwpr	control cable	0.23	MS3126F-10-6S	cntr sec to loc B	MS3126F-10-6P	24

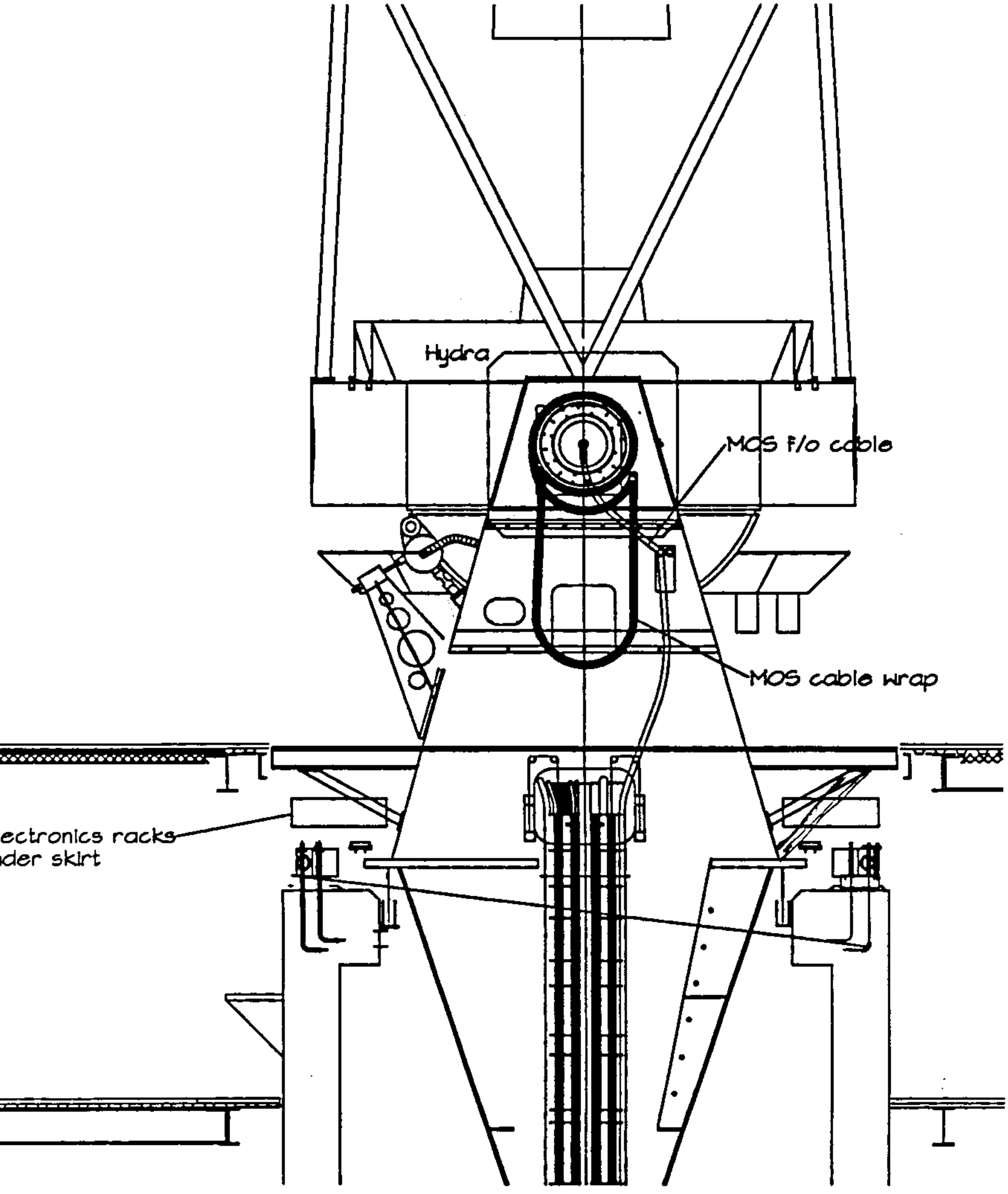
Table 9

AC Power Distribution on the Telescope

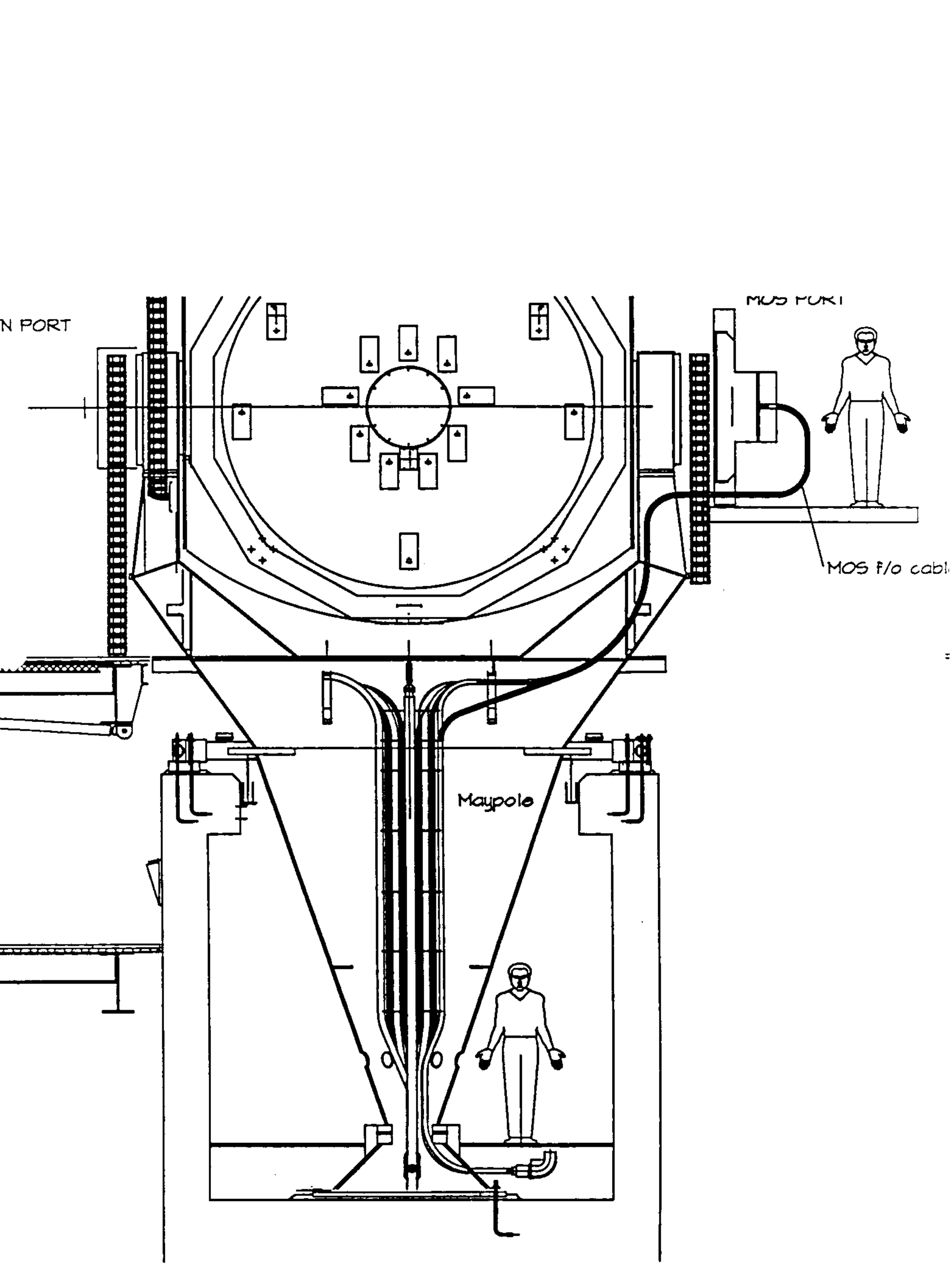
	description	function	dia	connector, from	route description	connector, to	AWG
ACMB	3 cond, 20Amp	AC,mtn ckt 1, blowers	0.64	terminal strip	-	PM cell	12
ACMO	3 cond, 20Amp	AC,mtn ckt 2, OSS	0.64	terminal strip	-	OSS	12
ACMG	3 cond, 20Amp	AC,mtn ckt 3, general	0.64	terminal strip	3 outlets		12
ACU1SK	3 cond, 20Amp	AC,UPS-1 ckt 1, skirt	0.64	terminal strip	up13,210	Hydra control	12
	3 cond, 20Amp	AC,UPS-1 ckt 1, Hydra	0.64	terminal strip	up13	MOS Port	12
ACU1W	3 cond, 20Amp	AC,UPS-1 ckt 2, WIYN	0.64	terminal strip	up17,1000	WIYN Port	12
ACU1O	3 cond, 20Amp	AC,UPS-1 ckt 3, OSS	0.64	terminal strip	up15,1050	OSS	12
ACU2E	3 cond, 20Amp	AC,UPS-2 ckt 1, El Dr	0.69	terminal strip	skirt	Elevation drive	10
ACU2N	3 cond, 20Amp	AC,UPS-2 ckt 2, NIR Dr	0.69	terminal strip	skirt	NIR drives	10
ACU2H	3 cond, 20Amp	AC,UPS-2 ckt 3,HydraDr	0.69	terminal strip	skirt	Hydra drive	10
ACU2A	3 cond, 20Amp	AC,UPS-2 ckt 4, Az Dr	0.69	terminal strip	top o f pier	Az drive	10

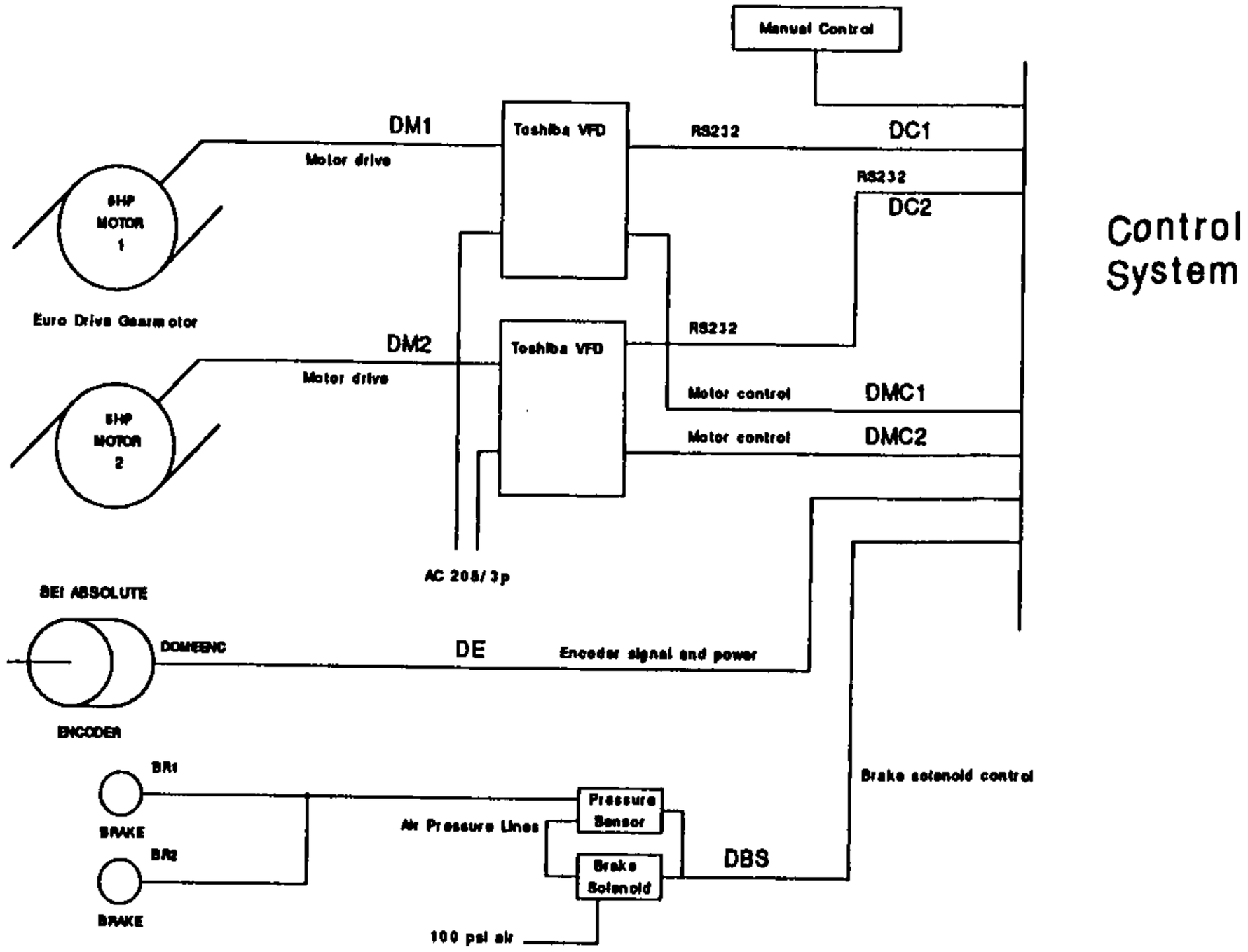
Table 10

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


Hydra
MOS f/o cable
MOS cable wrap
ectronics racks
der skirt

Electronics racks
Under skirt
Instrument Lift Platfor
Hydra
WIYN PORT
MOS PORT


N PORT
MOS PORT
MOS f/o cabl
Maypole



Control System

Figure 2 Dome Azimuth Drive

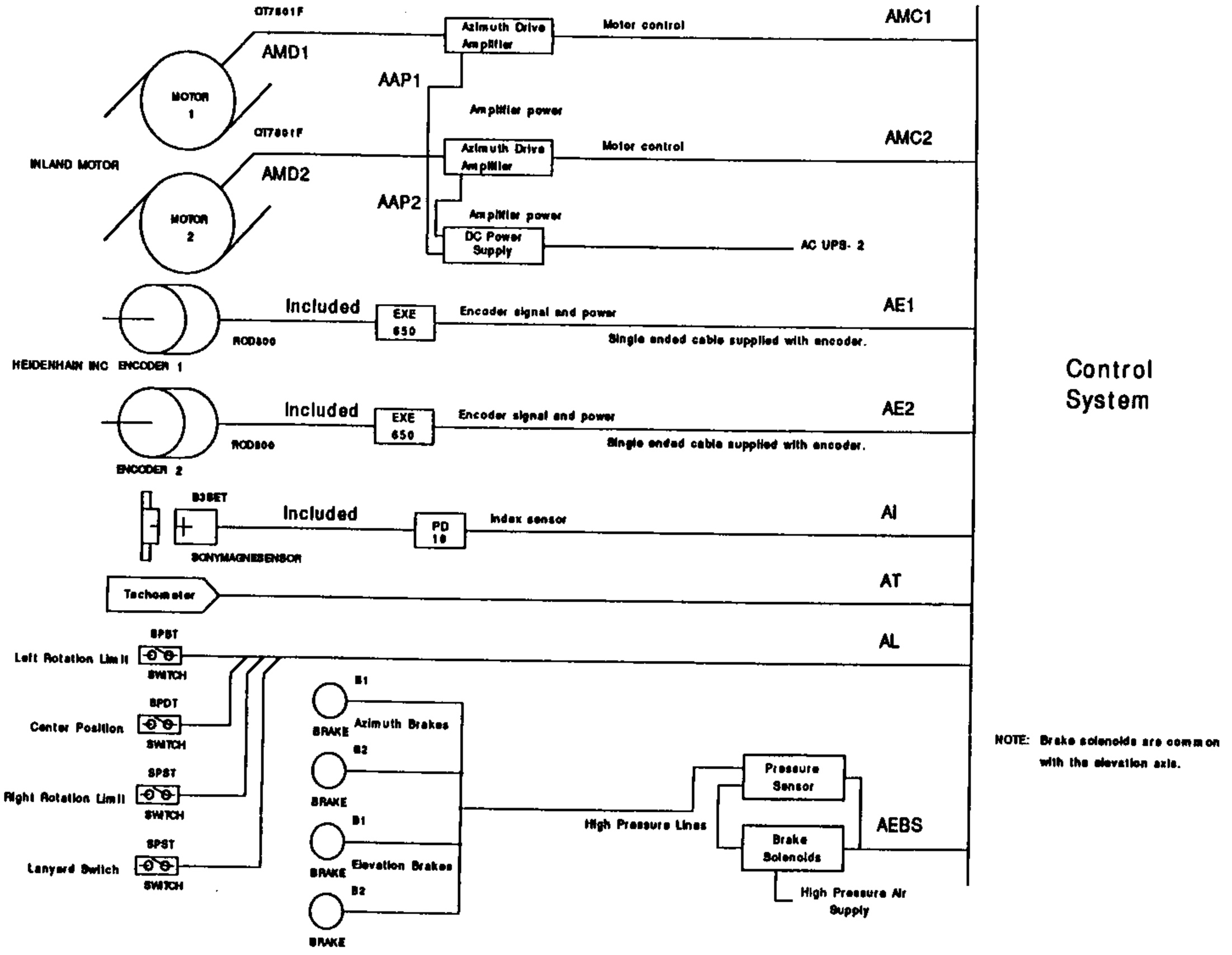


Figure 3 Telescope Azimuth Drive

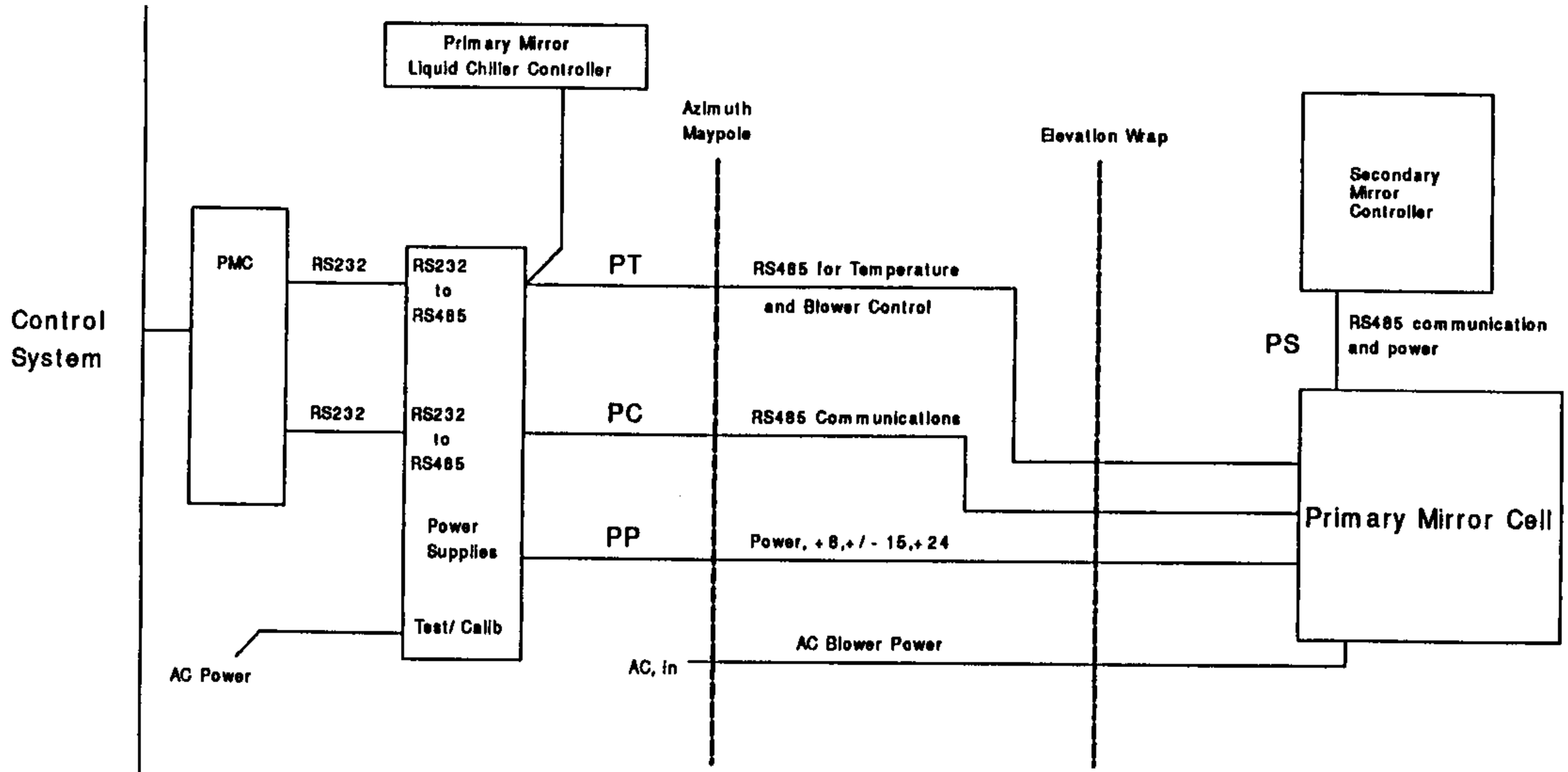


Figure 4 Primary Mirror Subsystem

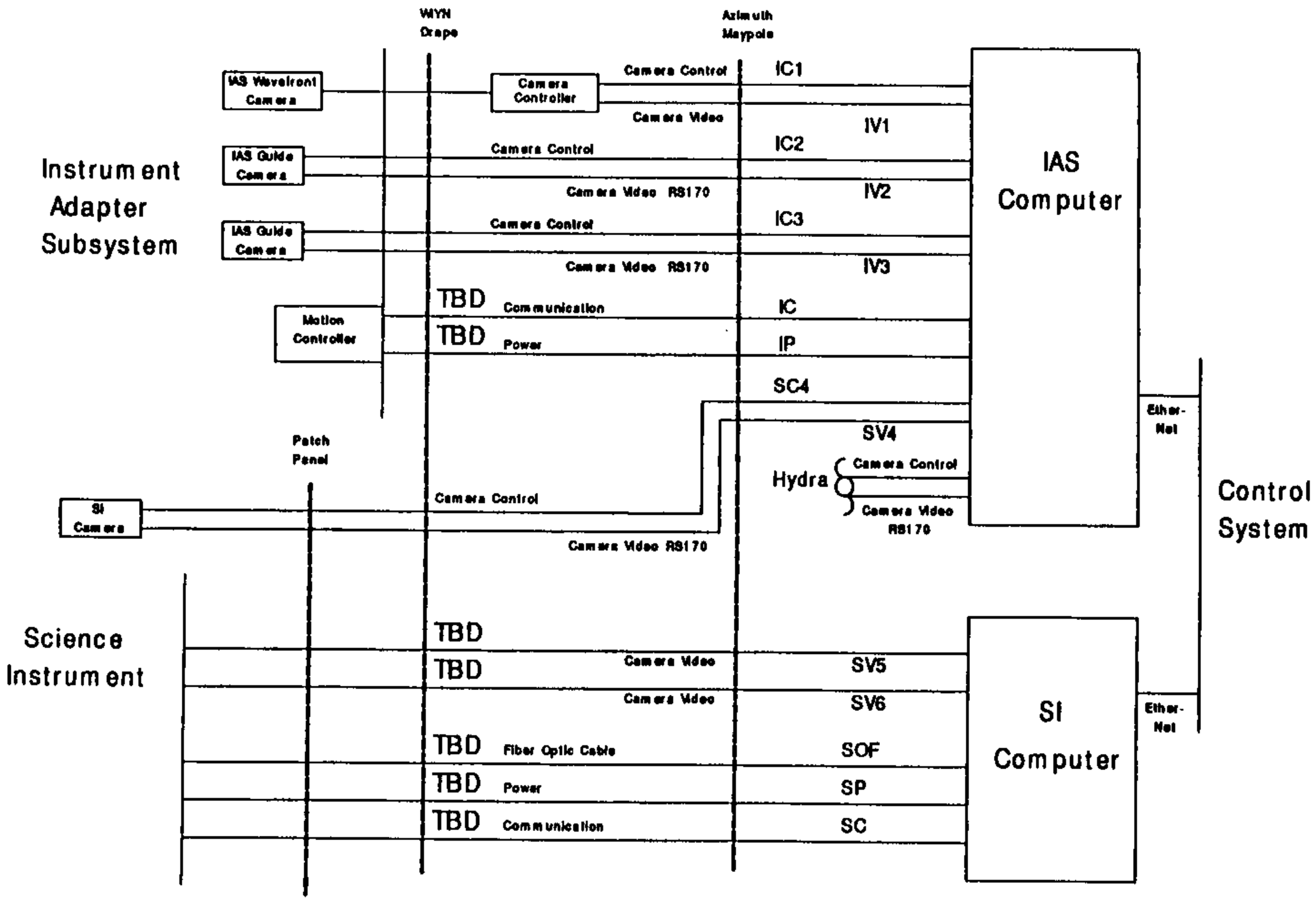


Figure 5 WIYN Port, SI and IAS

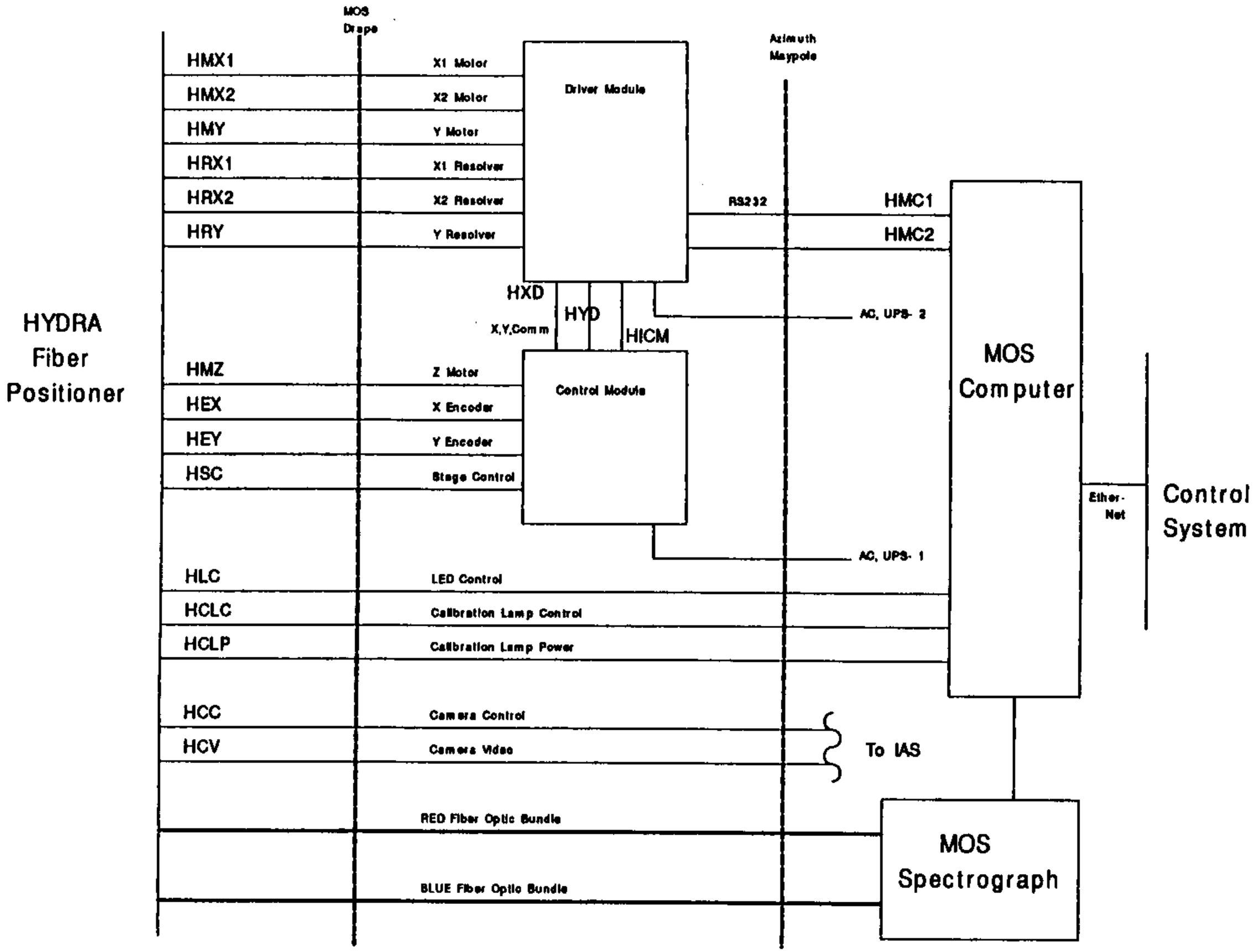


Figure 6 Hydra and MOS

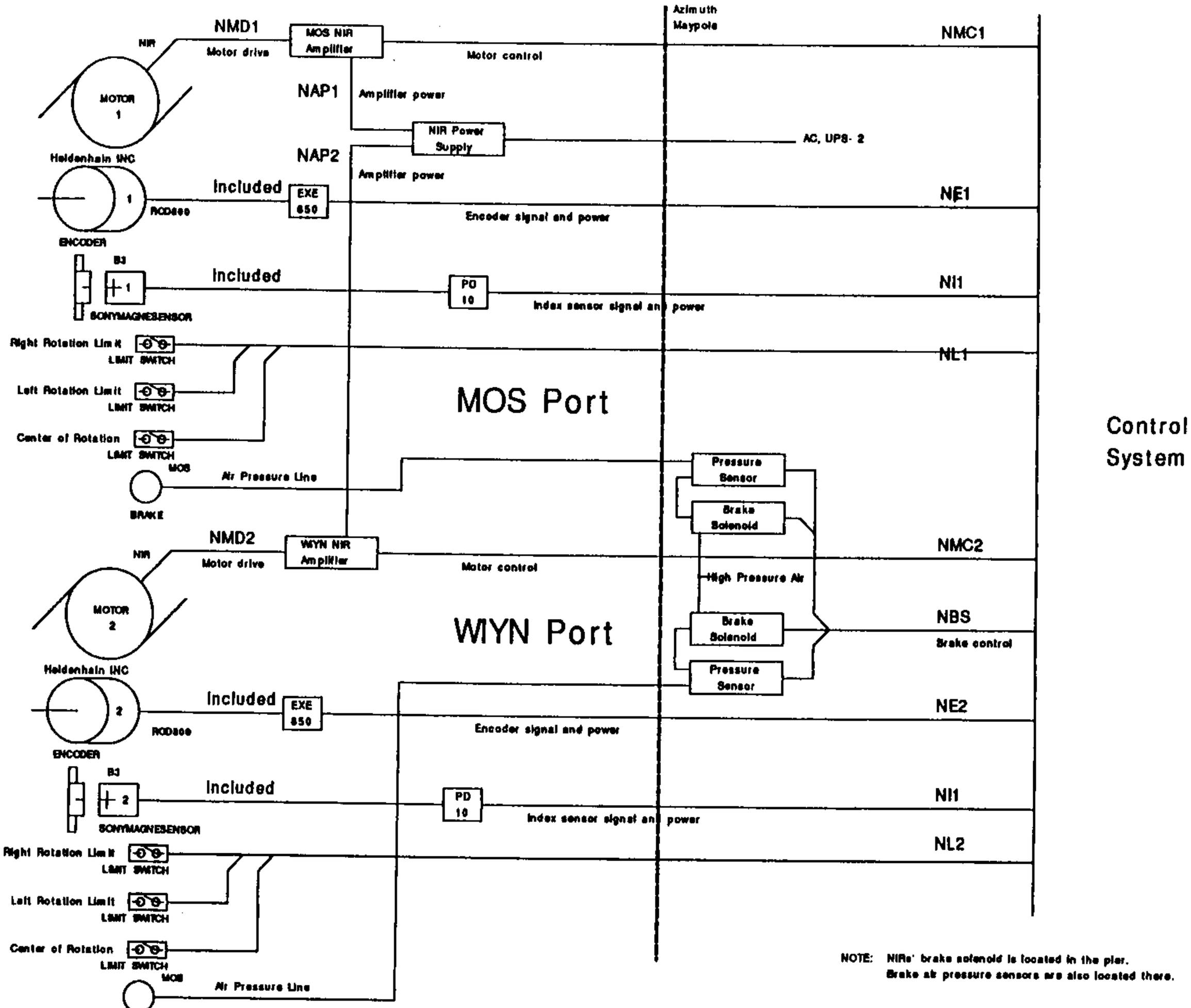
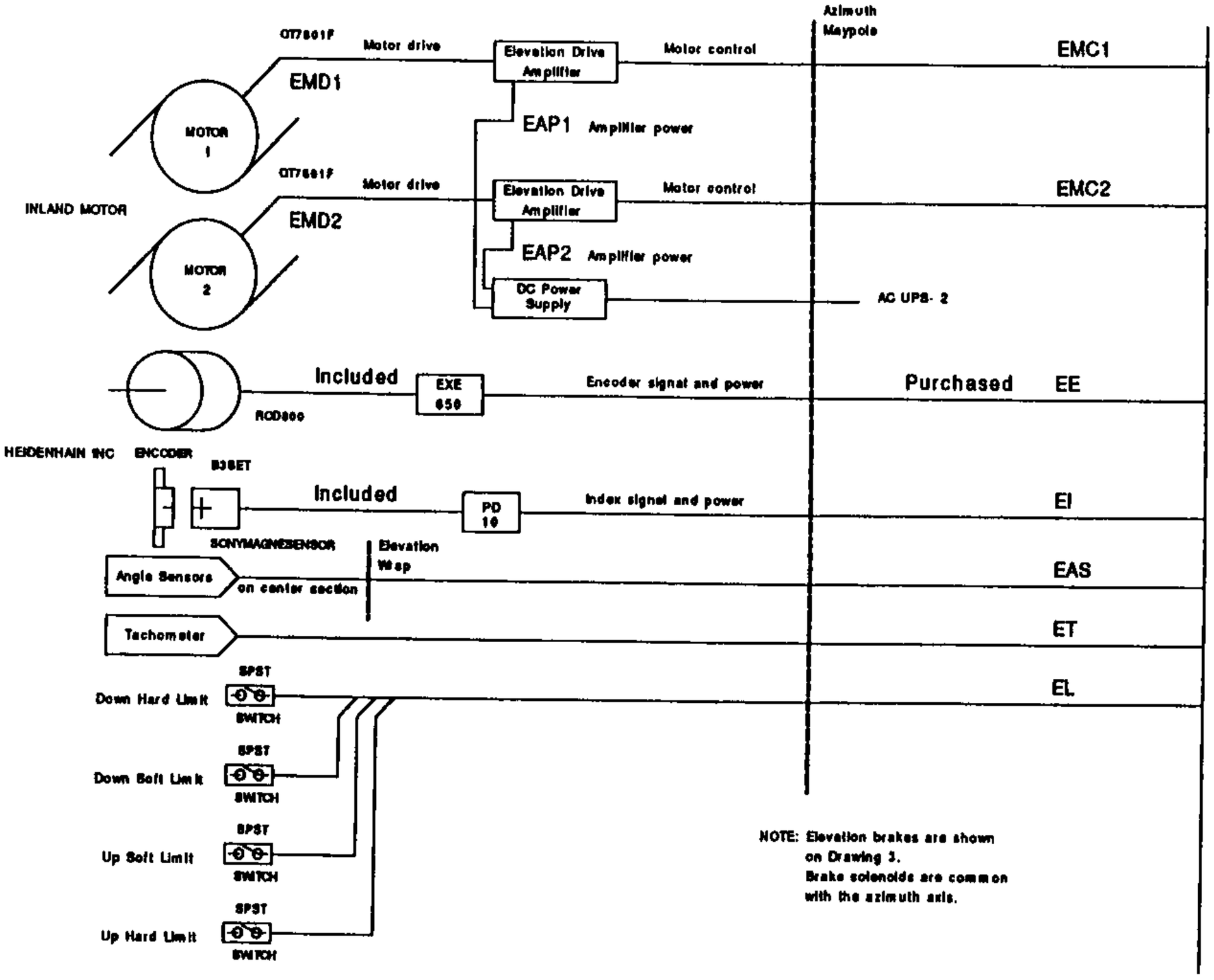


Figure 7 MOS and WYN NIRs

Control System



Control System

Figure 8 Telescope Elevation Drive

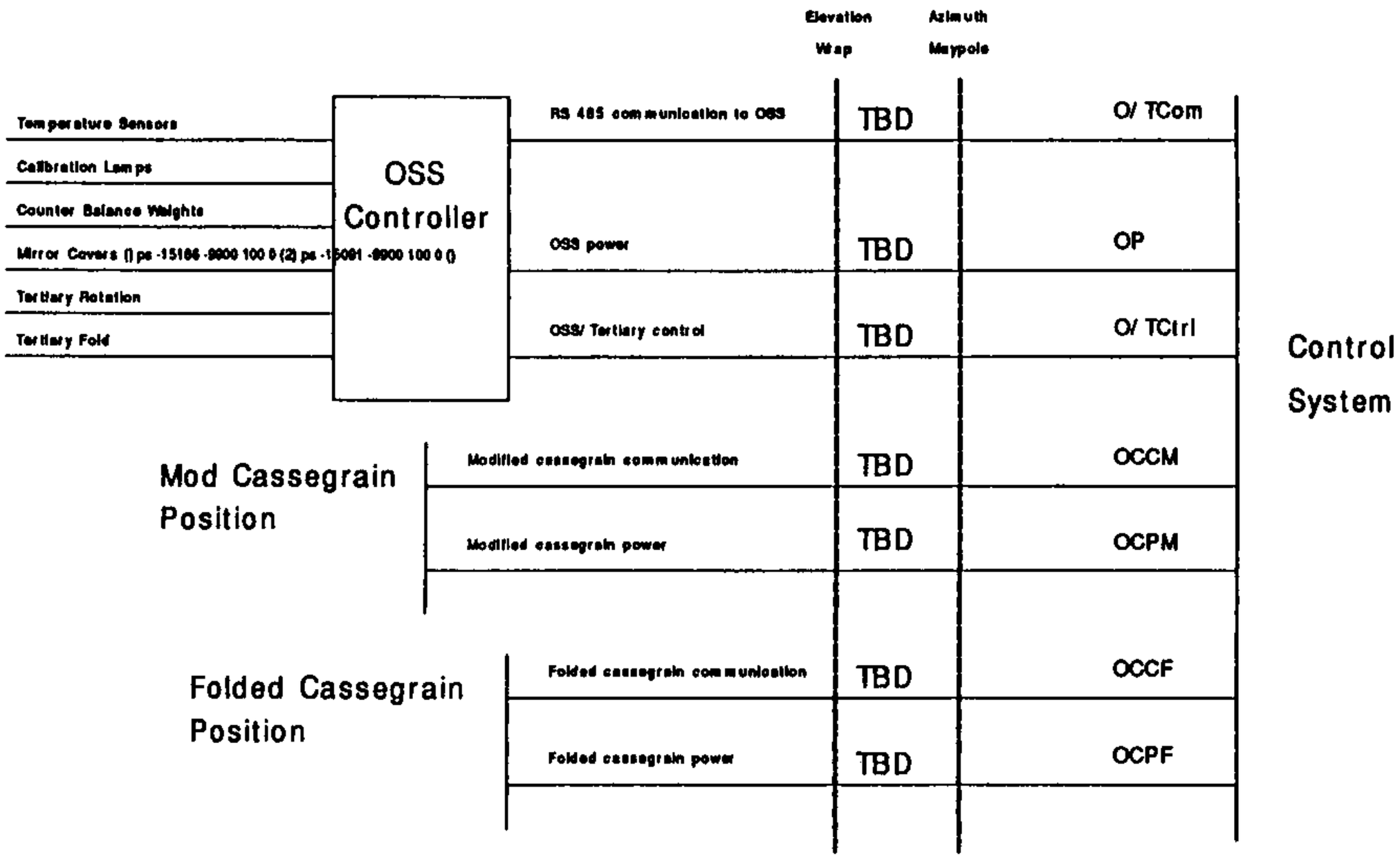


Figure 9 OSS Control Subsystem