



GOVERNMENT OF INDIA  
Bhabha Atomic Research Centre

GMRT STATION SERVO COMPUTER  
OPERATIONS AND MAINTENANCE  
MANUAL

REACTOR CONTROL DIVISION  
B.A.R.C. TROMBAY  
BOMBAY - 400 085

DEC' 92



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GMRT SSC OPERATIONS AND MAINTENANCE MANUAL

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## 1. BIN WIRING DETAILS

### 1.1 LAYOUT AND CONNECTOR DETAILS

#### 1.1.1 Euro Connectors layout

Slot Card		Connectors		
		EURO (socket)	D TYPE (socket)	FRC (plug)
P01	CPU 86X	64 PIN	25 PIN(D0)	26 PIN(F1)
P02	-----	-----	-----	-----
P03	ENCODER CARD	64 PIN	-----	26 PIN(F2,F3)
P04	DIGITAL INPUT CARD 1	64 PIN	-----	-----
P05	DIGITAL INPUT CARD 2	64 PIN	-----	-----
P06	ANALOG I/O CARD	64 PIN	-----	34 PIN(F4)
P07	TTL O/P CARD	64 PIN	-----	-----
P08	----- (Spare)	64 PIN	-----	-----
P09	RELAY CARD	64 PIN	-----	-----

#### 1.1.2 D TYPE (25 PIN) BACKPLATE CONNECTORS

No.	Signals	Connector type
D01	SSC LINK	Socket type
D02	HHT LINK	S
D03	AZ ENCODER I/P	Plug type
D04	EL ENCODER I/P	S
D05	AZ FIELD I/P	P
D06	EL FIELD I/P	S
D07	INTERLOCK CARDS I/O	P
D08	CONSOLE I/O	S

#### 1.1.3 FLAT RIBBON CABLE CONNECTORS

No.	Signals	Type	Termination
F1	NC	26 PIN	--
F2	DISPLAY	26 PIN	F5..F10 (on display cards)
F3	ENCODER	26 PIN	D3
F4	ANALOG I/O	34 PIN	D7

## 1.2 Signal labels and numbering conventions

### 1.2.1 DIGITAL I/Ps

-----  
01 AZ-STWG

02 AZ-STRLSG

03 AZ-ON-IP

04 AZ-STP-LMT

05 AZ-M1-OL

06 AZ-M2-OL

07 AZ1-BRKD

08 AZ2-BRKD

09 AZ-FLMT-CW

10 AZ-FLMT-CCW

11 AZ-C1ST

12 AZ-C2ST

13 AZ-A1-OL

14 AZ-A2-OL

15 AZ-STWD

16 AZ-STRLSD

17 EL-STWG

18 EL-STRLSG

19 EL-ON-IP

20 EL-STP-LMT

21 EL-M1-OL

22 EL-M2-OL

23 EL1-BRKD

24 EL2-BRKD

25 EL-FLMT-UP

26 EL-FLMT-DN

27 EL-C1ST

28 EL-C2ST

29 EL-A1-OL

30 EL-A2-OL

31 EL-STWD

32 EL-STRLSD

33 CWRP-SIGN

34 MAN-IP

35 LOC-TP

36 REM-IP

37 PS1-OK

- 38 PS2-OK  
 39 PH3-PS-OK  
 40 DIP-39  
 41 DIP-40  
 42 EM-PARK1  
 43 DIP-42  
 44 CWRP  
 45 DIP-44  
 46 DIP-45  
 47 DIP-46  
 48 DIP-47

### 1.2.2 DIGITAL O/Ps

01 AZ-ON-OP	28/03/2011	L1E3	L2
02 AZ-STW	28/03/2011	L1E3	L2
03 AZ-STRLS	28/03/2011	L1E3	L2
04 AZ-SIG	28/03/2011	L1E3	L2
05 AZ-CAGE	28/03/2011	L1E3	L2
06 AZ-POWER-ON	28/03/2011	L1E3	L2
07 OP-07	28/03/2011	L1E3	L2
08 EL-ON-OP	28/03/2011	L1E3	L2
09 EL-STW	28/03/2011	L1E3	L2
10 EL-STRLS	28/03/2011	L1E3	L2
11 EL-SIG	28/03/2011	L1E3	L2
12 EL-CAGE	28/03/2011	L1E3	L2
13 EL-POWER-ON	28/03/2011	L1E3	L2
14 OP-14	28/03/2011	L1E3	L2
15 EM-PARK	28/03/2011	L1E3	L2
16 SSC-OK	28/03/2011	L1E3	L2

### 1.2.3 ANALOG I/Ps

- 01 AZM1-CR  
 02 AZM2-CR  
 03 ELM1-CR  
 04 ELM2-CR  
 05 AZ1-TACO  
 06 AZ2-TACO  
 07 EL1-TACO  
 08 EL2-TACO  
 09 AZ-POSPOT

## 10 EL-POSPOT

### 1.2.4 ANALOG O/Ps

---

01 AZ-ERR+  
02 AZ ERR-  
03 EL-ERR+  
04 EL ERR-

### 1.2.5 ENCODER SIGNALS

---

01 GND  
02 VCC  
03 INH0+  
04 INH0-  
05 ECLK0+  
06 ECLK0-  
07 ED0+  
08 ED0-  
09 INH1+  
10 INH1-  
11 ECLK1+  
12 ECLK1-  
13 ED1+  
14 ED1-

### 1.2.6 ANEMOMETER SIGNALS

---

01 WV0+  
02 WV0-  
03 WV1+  
04 WV1-

### 1.3 EURO CONNECTORS WIRING TABLES

#### P1 CPU86X

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(B)	RED	C 02	VCC	BB1(B)	RED
A 03				C 03			C 32
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07				C 07			
A 08				C 08			
A 09				C 09			
A 10				C 10			
A 11				C 11			
A 12				C 12			
A 13				C 13			
A 14				C 14			
A 15				C 15			
A 16				C 16			
A 17				C 17			
A 18				C 18			
A 19				C 19			
A 20				C 20			
A 21				C 21			
A 22				C 22			
A 23				C 23			
A 24				C 24			
A 25				C 25			
A 26				C 26			
A 27				C 27			
A 28				C 28			
A 29				C 29			
A 30	+15V		BLUE	C 30	-15V		GREEN
A 31	GND	BB2(D)	BLACK	C 31	GND	BB2(D)	BLACK
A 32	VCC	BB2(A)	RED	C 32	VCC	BB2(A)	RED
							C 32

#### P3 ENCDR

PIN	SIGNAL	LEV 1	COLOUR	PIN	SIGNAL	LEV1	COLOUR
-----	--------	-------	--------	-----	--------	------	--------

NO.

NO

A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(B)	RED	C 02	VCC	BB1(B)	RED
A 03				C 03			
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07				C 07			
A 08				C 08			
A 09				C 09			
A 10				C 10			
A 11				C 11			
A 12				C 12			
A 13				C 13			
A 14				C 14			
A 15				C 15			
A 16				C 16			
A 17				C 17			
A 18				C 18			
A 19				C 19			
A 20				C 20			
A 21				C 21			
A 22				C 22			
A 23				C 23			
A 24				C 24			
A 25				C 25			
A 26	WV0+	D7(10)	BROWN	C 26	WV0-	D7(11)	RED
A 27	WV1+	D7(12)	ORANGE	C 27	WV1-	D7(13)	YELLOW
A 28				C 28			
A 29				C 29			
A 30	+15V		BLUE	C 30	-15V		GREEN
A 31	GND	BB2(D)	BLACK	C 31	GND	BB2(D)	BLACK
A 32	VCC	BB2(A)	RED	C 32	VCC	BB2(A)	RED
							C 32

## P4 DIP 1

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(A)	RED	C 02	VCC	BB1(A)	RED
A 03				C 03			

7      *Padger*      } 40      1 2 3 4 5 6 7 8  
*E. S. L.*      } 40      6 ↓ 4 ↓ 1 3 1 2 5 ↓ 1 ↓

Check Solder  
D1 (3D) & P5

Check Solder  
Formal Number D5(2) & D5C3

A 04		C 04	
A 05		C 05	Formal Number D5(2) & D5C3
A 06		C 06	Formal Number D5(2) & D5C3
A 07	EL-M1-OL	D6(02)	GREEN C 07 EL-M2-OL
A 08	EL1-BRKD	D7(03)	VIOLET C 08 EL2-BRKD
A 09			C 09
A 10			C 10
A 11			C 11
A 12			C 12
A 13			C 13 AZ-STWG
A 14	AZ-STRLSG		C 14 AZ-ON-IP
A 15	AZ-STP-LMT		C 15 AZ-M1-OL
A 16	AZ-M2-OL	D5(03)	BLUE C 16 AZ1-BRKD
A 17	AZ2-BRKD	D7(02)	GRAY C 17 EL-STWG
A 18	EL-STRLSG	D6(13)	RED C 18 EL-ON-IP
A 19	EL-STP-LMT	D6(14)	YELLOW C 19
A 20			C 20
A 21			C 21
A 22			C 22
A 23			C 23
A 24	AZ-FLMT-CW	D5(04)	BROWN C 24 AZ-FLMT-CCW
A 25	AZ-CIST	D5(06)	ORANGE C 25 AZ-C2ST
A 26	AZ-A1-OL	D5(08)	GREEN C 26 AZ-A2-OL
A 27	AZ-STWD		C 27 AZ-STRLSB
A 28			C 28
A 29			C 29
A 30	+15V		BLUE C 30 -15V
A 31	GND	BB2(D)	BLACK C 31 GND
A 32	VCC	BB2(A)	RED C 32 VCC

P5 DIP 2

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(A)	RED	C 02	VCC	BB1(A)	RED
A 03				C 03			C 32
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07	DIP-44			C 07	DIP-45		
A 08	DIP-46			C 08	DIP-47		



A 09			C 09				
A 10			C 10				
A 11			C 11				
A 12			C 12				
A 13			C 13	EL-FLMT-UP	D6(04)	BROWN	
A 14	EL-FLMT-DN	D6(05)	RED	C 14	EL-CIST	D6(06)	ORANGE
A 15	EL-C2ST	D6(07)	YELLOW	C 15	EL-A1-OL	D6(08)	GREEN
A 16	EL-A2-OL	<u>D6(09)</u>	BLUE	C 16	EL-STWD	D6(10)	VIOLET
A 17	EL-STRLSD	D6(11)	GRAY	C 17	DIP-40		
A 18	EM-PARK1	D7(8)	RED	C 18	DIP-12		
A 19	CWRP	D5(11)	YELLOW	C 19			
A 20				C 20			
A 21				C 21			
A 22				C 22			
A 23				C 23			
A 24	CWRP-SIGN	D5(10), F3(12)	BR.RD	C 24	MAN-IP	D8(01)	RED
A 25	LOC-1P	D8(02)	ORANGE	C 25	REM-1P	D8(03)	YELLOW
A 26	PS1-OK	D7(05)	GREEN	C 26	PS2-OK	D7(06)	BLUE
A 27	PH3-PS-OK	D7(07)	VIOLET	C 27	DIP-39		
A 28				C 28			
A 29				C 29			
A 30	+15V		BLUE	C 30	-15V		GREEN
A 31	GND	BB2(D)	BLACK	C 31	GND	BB2(D)	BLACK
A 32	VCC	BB2(A)	RED	C 32	VCC	BB2(A)	RED
							C 32

Note: Short two wires from P5(A24) and F3(12) at D5(10)

#### P6 ANALOG I/O

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(B)	RED	C 02	VCC	BB1(B)	RED
A 03				C 03			
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07				C 07			
A 08				C 08			
A 09				C 09			
A 10				C 10			
A 11				C 11			
A 12				C 12			

A 13		C 13			
A 14		C 14			
A 15		C 15			
A 16		C 16			
A 17		C 17			
A 18		C 18			
A 19		C 19			
A 20		C 20			
A 21		C 21			
A 22		C 22			
A 23		C 23			
A 24		C 24			
A 25		C 25			
A 26		C 26			
A 27		C 27			
A 28		C 28			
A 29		C 29			
A 30 +15V		BLUE	C 30 -15V		GREEN
A 31 GND	BB2(D)	BLACK	C 31 GND	BB2(D)	BLACK
A 32 VCC	BB2(A)	RED	C 32 VCC	BB2(A)	RED
					C 32

P7 TTL O/P

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(A)	RED	C 02	VCC	BB1(A)	RED
A 03				C 03			C 32
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07				C 07			
A 08				C 08			
A 09				C 09			
A 10				C 10			
A 11				C 11			
A 12				C 12			
A 13				C 13			
A 14 AZ-ON-OP	P9(A2)	BROWN	C 14 AZ-STW				
A 15 AZ-STRLS			C 15 AZ-SIG	P9(C3)	YELLOW		
A 16 AZ-CAGE	P9(A4)	GREEN	C 16 AZ-POWER-ON	P9(C4)	BLUE		
A 17 OP-7	P9(A5)	VIOLET	C 17 EL-ON-OP	P9(C5)	GRAY		
A 18 EL-STW	P9(A6)	BROWN	C 18 EL-STRLS	P9(C6)	RED		

A 19	EL-SIG	P9(A7)	ORANGE	C 19	EL-CAGE	P9(C7)	YELLOW
A 20				C 20			
A 21				C 21			
A 22				C 22			
A 23				C 23			
A 24	EL-POWER-ON	P9(A8)	GREEN	C 24	OP-14	P9(C8)	BLUE
A 25	EM-PARK	P9(A9)	VIOLET	C 25			
A 26				C 26			
A 27				C 27			
A 28	SSC-OK	P9(C9)	GRAY	C 28			
A 29				C 29			
A 30	+15V		BLUE	C 30	-15V		GREEN
A 31	GND	BB2(D)	BLACK	C 31	GND	BB2(D)	BLACK
A 32	VCC	BB2(A)	RED	C 32	VCC	BB2(A)	RED
							C 32

#### P8 spare

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	GND	BB1(B)	BLACK	C 01	GND	BB1(B)	BLACK
A 02	VCC	BB1(B)	RED	C 02	VCC	BB1(B)	RED
A 03				C 03			
A 04				C 04			
A 05				C 05			
A 06				C 06			
A 07				C 07			
A 08				C 08			
A 09				C 09			
A 10				C 10			
A 11				C 11			
A 12				C 12			
A 13				C 13			
A 14				C 14			
A 15				C 15			
A 16				C 16			
A 17				C 17			
A 18				C 18			
A 19				C 19			
A 20				C 20			
A 21				C 21			
A 22				C 22			
A 23				C 23			

A 24			C 24		
A 25			C 25		
A 26			C 26		
A 27			C 27		
A 28			C 28		
A 29			C 29		
A 30 +15V		BLUE	C 30 -15V		GREEN
A 31 GND	BB2(D)	BLACK	C 31 GND	BB2(D)	BLACK
A 32 VCC	BB2(A)	RED	C 32 VCC	BB2(A)	RED
					C 32

#### P09 RELAY

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	VCC	BB1(A)	RED	C 01	VCC	BB1(A)	RED
A 02	AZ-ON-OP	P7(A14)	BROWN	C 02	AZ-STW	P7(C12)	
A 03	AZ-STRLS	P7(A15)		C 03	AZ-SIG	P7(C15)	YELLOW
A 04	AZ-CAGE	P7(A16)	GREEN	C 04	AZ-POWER-ON	P7(C16)	BLUE
A 05	OP-7	P7(A17)	VIOLET	C 05	EL-ON-OP	P7(C17)	GRAY
A 06	EL-STW	P7(A18)	BROWN	C 06	EL-STRLS	P7(C18)	RED
A 07	EL-SIG	P7(A19)	ORANGE	C 07	EL-CAGE	P7(C19)	YELLOW
A 08	EL-POWER-ON	P7(A24)	GREEN	C 08	OP-14	P7(C24)	BLUE
A 09	EM-PARK	P7(A25)	VIOLET	C 09	SSC-OK	P7(A28)	GRAY
A 10	AZ-ON-OP-NO	D8(04)	BLACK	C 10	AZ-ON-OP-C	D8(05)	BROWN
A 11	AZ-ON-OP-NC			C 11	AZ-STW-NO		
A 12	AZ-STW-C			C 12	AZ-STW-NC		
A 13	AZ-STRLS-NO			C 13	AZ-STRLS-C		
A 14	AZ-STRLS-NC			C 14	AZ-SIG-NO	F4(19)	WHITE
A 15	AZ-SIG-C	D7(19)	WHITE	C 15	AZ-SIG-NC		WHITE
A 16	AZ-CAGE-NO	D8(06)	BLACK	C 16	AZ-CAGE-C	D8(07)	GREEN
A 17	AZ-CAGE-NC			C 17	AZ-POWER-ON-NO	D8(20)	BLACK
A 18	AZ-POWER-ON-C	D8(21)	BLUE	C 18	AZ-POWER-ON-NC		
A 19	OP-7-NO			C 19	OP-7-C		
A 20	OP-7-NC			C 20	EL-ON-OP-NO	D8(08)	BLACK
A 21	EL-ON-OP-C	D8(09)	GRAY	C 21	EL-ON-OP-NC		
A 22	EL-STW-NO	D8(10)	BLACK	C 22	EL-STW-C	D8(11)	BROWN
A 23	EL-STW-NC			C 23	EL-STRLS-NO	D8(12)	BLACK
A 24	EL-STRLS-C	D8(13)	RED	C 24	EL-STRLS-NC		
A 25	EL-SIG-NO	F4(21)	BROWN	C 25	EL-SIG-C	D7(21)	BROWN
A 26	EL-SIG-NC		WHITE	C 26	EL-CAGE-NO	D8(14)	BLACK
A 27	EL-CAGE-C	D8(15)	YELLOW	C 27	EL-CAGE-NC		
A 28	EL-POWER-ON-NO	D8(22)	BLACK	C 28	EL-POWER-ON-C	D8(23)	GREEN
A 29	OP-14-NO			C 29	OP-14-C		

A 24			C 24			
A 25			C 25			
A 26			C 26			
A 27			C 27			
A 28			C 28			
A 29			C 29			
A 30 +15V		BLUE	C 30 -15V			GREEN
A 31 GND	BB2(D)	BLACK	C 31 GND	BB2(D)	BLACK	
A 32 VCC	BB2(A)	RED	C 32 VCC	BB2(A)	RED	C 32

#### P09 RELAY

PIN NO.	SIGNAL	LEV 1	COLOUR	PIN NO.	SIGNAL	LEV1	COLOUR
A 01	VCC	BB1(A)	RED	C 01	VCC	BB1(A)	RED
A 02	AZ-ON-OP	P7(A14)	BROWN	C 02	AZ-STW		
A 03	AZ-STRLS			C 03	AZ-SIG	P7(C15)	YELLOW
A 04	AZ-CAGE	P7(A16)	GREEN	C 04	AZ-POWER-ON	P7(C16)	BLUE
A 05	OP-7	P7(A17)	VIOLET	C 05	EL-ON-OP	P7(C17)	GRAY
A 06	EL-STW	P7(A18)	BROWN	C 06	EL-STRLS	P7(C18)	RED
A 07	EL-SIG	P7(A19)	ORANGE	C 07	EL-CAGE	P7(C19)	YELLOW
A 08	EL-POWER-ON	P7(A24)	GREEN	C 08	OP-14	P7(C24)	BLUE
A 09	EM-PARK	P7(A25)	VIOLET	C 09	SSC-OK	P7(A28)	GRAY
A 10	AZ-ON-OP-NO	D8(04)	BLACK	C 10	AZ-ON-OP-C	D8(05)	BROWN
A 11	AZ-ON-OP-NC			C 11	AZ-STW-NO		
A 12	AZ-STW-C			C 12	AZ-STW-NC		
A 13	AZ-STRLS-NO			C 13	AZ-STRLS-C		
A 14	AZ-STRLS-NC			C 14	AZ-SIG-NO	F4(19)	WHITE
A 15	AZ-SIG-C	D7(19)	WHITE	C 15	AZ-SIG-NC		WHITE
A 16	AZ-CAGE-NO	D8(06)	BLACK	C 16	AZ-CAGE-C	D8(07)	GREEN
A 17	AZ-CAGE-NC			C 17	AZ-POWER-ON-NO	D8(20)	BLACK
A 18	AZ-POWER-ON-C	D8(21)	BLUE	C 18	AZ-POWER-ON-NC		
A 19	OP-7-NO			C 19	OP-7-C		
A 20	OP-7-NC			C 20	EL-ON-OP-NO	D8(08)	BLACK
A 21	EL-ON-OP-C	D8(09)	GRAY	C 21	EL-ON-OP-NC		
A 22	EL-STW-NO	D8(10)	BLACK	C 22	EL-STW-C	D8(11)	BROWN
A 23	EL-STW-NC			C 23	EL-STRLS-NO	D8(12)	BLACK
A 24	EL-STRLS-C	D8(13)	RED	C 24	EL-STRLS-NC		
A 25	EL-SIG-NO	F4(21)	BROWN	C 25	EL-SIG-C	D7(21)	BROWN
A 26	EL-SIG-NC		WHITE	C 26	EL-CAGE-NO	D8(14)	BLACK
A 27	EL-CAGE-C	D8(15)	YELLOW	C 27	EL-CAGE-NC		
A 28	EL-POWER-ON-NO	D8(22)	BLACK	C 28	EL-POWER-ON-C	D8(23)	GREEN
A 29	OP-14-NO			C 29	OP-14-C		

A 30	EM-PARK-NO	D8(16)	BLACK	C 30	EM-PARK-C	D8(17)	VIOLET
A 31	SSC-OK-NO	D8(18)	BLACK	C 31	SSC-OK-C	D8(19)	GRAY
A 32	GND	BB2(D)	BLACK	C 32	GND	BB2(D)	BLACK

#### 1.4 D TYPE CONNECTORS WIRING TABLES

---

##### COM-BRD (SSC\_BRD FOR RS-422 COMMUNICATION)

---

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	+5V	BB2(A)		RED
2	P.S.GND	BB2(D)		BLACK
3	+15V	BB2		BLUE
4	-15V	BB2		GREEN
5	TX-SSC	D0(3)	D1(3)	YELLOW
6	TX-SSC+	D1(8)		BLUE
7	TX-SSC-	D1(9)		VIOLET
8	RX-SSC+	D1(10)		GRAY
9	RX-SSC-	D1(11)		WHITE
10	RX-SSC	D0(2)	D1(2)	RED

---

##### DO(CPU86X)

---

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	NC			
2	RX-SSC	D1(2)	COM(10)	RED
3	TX-SSC	D1(3)	COM(5)	YELLOW
4	NC			
5	NC			
6	NC			
7	SIG-GND	D1(7)	D2(7)	GREEN,WHITE
8	NC			
9	RX-HHT	D2(2)		BLUE
10	TX-HHT	D2(3)		GRAY
11	NC			
12	NC			
13	NC			
14	NC			
15	NC			
16	NC			

17 NC  
18 NC  
19 NC  
20 NC  
21 NC  
22 NC  
23 NC  
24 NC  
25 NC

---

#### D1(SSC)

PIN NO.	SIGNAL	LEV1	COLOUR
1	P.S.GND	BB2(D)	BLACK
2	RX-SSC	DO(2)	RED
3	TX-SSC	DO(3)	YELLOW
5	NC		
6	NC		
7	SIG-GND	DO(7)	GREEN
8	TX-SSC+	COM(6)	BLUE
9	TX-SSC-	COM(7)	VIOLET
10	RX-SSC+	COM(8)	GRAY
11	RX-SSC-	COM(9)	WHITE
12	NC		
13	NC		
14	+5V	BB2(A)	RED
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	NC		
23	NC		
24	NC		
25	NC		

---

#### D2(HHT)

PIN NO.	SIGNAL	LEV1	COLOUR
---------	--------	------	--------

---

1	P.S.GND	BB2(D)	BLACK
2	RX-HHT	D0(9)	BLUE
3	TX-HHT	D0(10)	GRAY
4	NC		
5	NC		
6	NC		
7	SIG-GND	D0(7)	WHITE
8	NC		
9	NC		
10	NC		
11	NC		
12	NC		
13	NC		
14	+5V	BB2(A)	RED
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	NC		
23	NC		
24	NC		
25	NC		

### D3(AZ ENC)

PIN NO.	SIGNAL	LEV1	COLOUR
1	GND	BB2(D)	BLACK
2	GND	BB2(D)	BLACK
3	VCC	BB2(A)	RED
4	VCC	BB2(A)	RED
5	INH0+	F3(5)	GREEN
6	INH0-	F3(6)	BLUE
7	ECLK0+	F3(7)	VIOLET
8	ECLK0-	F3(8)	GRAY
9	ED0+	F3(9)	WHITE
10	ED0-	F3(10)	BLACK
11	NC		
12	NC		
13	NC		

14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC
21	NC
22	NC
23	NC
24	NC
25	NC

---

#### D4 (EL ENC)

---

PIN NO.	SIGNAL	LEV1	COLOUR
1	GND	BB2(D)	BLACK
2	GND	BB2(D)	BLACK
3	VCC	BB2(A)	RED
4	VCC	BB2(A)	RED
5	TNH1+	F3(15)	GREEN
6	TNH1-	F3(16)	BLUE
7	ECLK1+	F3(17)	VIOLET
8	ECLK1-	F3(18)	GRAY
9	ED1+	F3(19)	WHITE
10	ED1-	F3(20)	BLACK
11	NC		
12	NC		
13	NC		
14	NC		
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	NC		
23	NC		
24	NC		
25	NC		

---

**D5(AZ FIELD IP)**

---

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	AZ-ON-IP	P4(C14)		ORANGE
2	AZ-M1-OL	P4(C15),D5(3)		GREEN
3	AZ-M2-OL	P4(A16),D5(2)		BLUE
4	AZ-FLMT-CW	P4(A24)		BROWN
5	AZ-FLMT-CCW	P4(C24)		RED
6	AZ-C1ST	P4(A25),D5(7)		ORANGE
7	AZ-C2ST	P4(C25),D5(6)		YELLOW
8	AZ-A1-OL	P4(A26),D5(9)		GREEN
9	AZ-A2-OL	P4(C26),D5(8)		BLUE
10	CWRP_SIGN	P5(A24),F3(12)		BROWN, RED
11	CWRP	P5(A19)		YELLOW
12	NC			
13	NC			
14	NC			
15	NC			
16	NC			
17	NC			
18	NC			
19	NC			
20	AZM1-CR	F4(3)		ORANGE
21	AZM2-CR	F4(4)		YELLOW
22	AZ-POSPOT+	F4(11)		BROWN
23	AZ-POSPOT-	BB1(B)		BLACK
24	AGND	BB1(B)		BLACK
25	GND	BB2(D)		BLACK

---

Note: Short two wires from P5(A24) and F3(12) at D5(10)

---

**D6(EL FIELD IP)**

---

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	EL-ON-IP	P4(C18)		ORANGE
2	EL-M1-OL	P4(A07),D6(3)		GREEN
3	EL-M2-OL	P4(C07),D6(2)		BLUE
4	EL-FLMT-UP	P5(C13)		BROWN
5	EL-FLMT-DN	P5(A14)		RED

6	EL-C1ST	P5(C14), D6(7)	ORANGE
7	EL-C2ST	P5(A15), D6(6)	YELLOW
8	EL-A1-OL	P5(C15), D6(9)	GREEN
9	EL-A2-OL	P5(A16), D6(8)	BLUE
10	EL-STWD	P5(C16)	VIOLET
11	EL-STRLSD	P5(A17)	GRAY
12	EL-STWG	P4(C17)	BROWN
13	EL-STRLSG	P4(A18)	RED
14	EL-STP-LMT	P4(A19)	YELLOW
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	ELM1-CR	F4(5)	GREEN
21	ELM2-CR	F4(6)	BLUE
22	EL-POSPOT+	F4(12)	RED
23	EL-POSPOT-	BB1(B)	BLACK
24	AGND	BB1(B)	BLACK
25	GND	BB2(D)	BLACK

---

#### D7 (INTERLOCK CARDS)

---

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	AZ1-BRKD	P4(C16), D7(2)		VIOLET
2	AZ2-BRKD	P4(A17), D7(1)		GRAY
3	EL1-BRKD	P4(A08), D7(4)		VIOLET
4	EL2-BRKD	P4(C08), D7(3)		GRAY
5	PS1-OK	P5(A26)		GREEN
6	PS2-OK	P5(C26)		BLUE
7	PH3-PS-OK	P5(A27)		VIOLET
8	EM-PARK1	P5(A18)		RED
9	NC			
10	WV0+	P3(A25)		BROWN
11	WV0-	P3(C25)		RED
12	WV1+	P3(A26)		ORANGE
13	WV1-	P3(C26)		YELLOW
14	AZ1-TACO	F4(7)		VIOLET
15	AZ2-TACO	F4(8)		GRAY
16	EL1-TACO	F4(9)		WHITE
17	EL2-TACO	F4(10)		BLACK
18	AGND	BB1(B)		BLACK
19	AZ-ERR+	P9(A15)		WHITE

20	AZ-ERR-	F4(20)	BLACK
21	EL-ERR+	P9(C25)	BROWN
22	EL-ERR	F4(22)	RED
23	NC		
24	NC		
25	DGND	BB2(D)	BLACK

#### D8 (INTERFACE WITH CONSOLE)

PIN NO.	SIGNAL	LEV1	COLOUR
1	MAN-IP	P5(C24)	RED
2	LOC-IP	P5(A25)	ORANGE
3	REM-IP	P5(C25)	YELLOW
4	AZ-ON-OP-NO	P9(A10)	BLACK
5	AZ-ON-OP-C	P9(C10)	BROWN
6	AZ-CAGE-NO	P9(A16)	BLACK
7	AZ-CAGE-C	P9(C16)	GREEN
8	EL-ON-OP-NO	P9(C20)	BLACK
9	EL-ON-OP-C	P9(A21)	GRAY
10	EL-STW-NO	P9(A22)	BLACK
11	EL-STW-C	P9(C22)	BROWN
12	EL-STRLS-NO	P9(C23)	BLACK
13	EL-STRLS-C	P9(A24)	RED
14	EL-CAGE-NO	P9(C26)	BLACK
15	EL-CAGE-C	P9(A27)	YELLOW
16	EM-PARK-NO	P9(A30)	BLACK
17	EM-PARK-C	P9(C30)	VIOLET
18	SSC-OK-NO	P9(A31)	BLACK
19	SSC-OK-C	P9(C31)	GRAY
20	AZ-POWER-NO	P9(C17)	BLACK
21	AZ-POWER-C	P9(A18)	BLUE
22	EL-POWER-NO	P9(A28)	BLACK
23	EL-POWER-C	P9(C28)	GREEN
24			
25	DGND		

#### 1.5 FRC CONNECTORS WIRING TABLES

 F2(DISPLAY) F5, F6, F7, F8, F9, F10 ARE ALL INTERCONNECTED

PIN TO PIN EXTERNALLY ON DISPLAY CARDS

PIN NO.	SIGNAL	LEV1	COLOUR
1	GND	F5(1)	BROWN
2	GND	F5(2)	RED
3	VCC	F5(3)	ORANGE
4	VCC	F5(4)	YELLOW
5	+15V	F5(5)	GREEN
6	FB6	F5(6)	BLUE
7	FA0	F5(7)	VIOLET
8	FA1	F5(8)	GRAY
9	FA2	F5(9)	WHITE
10	FA3	F5(10)	BLACK
11		F5(11)	BROWN
12	FA5	F5(12)	RED
13	FA6	F5(13)	ORANGE
14	FA7	F5(14)	YELLOW
15	FB7	F5(15)	GREEN
16	FB0	F5(16)	BLUE
17	FB1	F5(17)	VIOLET
18	FB2	F5(18)	GRAY
19	FB3	F5(19)	WHITE
20	FB4	F5(20)	BLACK
21	FB5	F5(21)	BROWN
22	+15V	F5(22)	RED
23	VCC	F5(23)	ORANGE
24	VCC	F5(24)	YELLOW
25	GND	F5(25)	GREEN
26	GND	F5(26)	BLUE

**F3(ENCODER)**

PIN NO.	SIGNAL	LEV1	LEV2	COLOUR
1	NC			
2	NC			
3	NC			
4	NC			
5	INH0+	D3(5)		GREEN
6	INH0-	D3(6)		BLUE
7	ECLK0+	D3(7)		VIOLET

8	ECLK0-	D3(8)	GRAY	
9	ED0+	D3(9)	WHITE	2 1
10	ED0-	D3(10)	BLACK	2 0
11	NC			
12	CWRP-SIGN	D5(10), P5(A24)	RED, BROWN	
13	NC			
14	NC			
15	INH1+	D4(5)	GREEN	
16	INH1-	D4(6)	BLUE	
17	ECLK1+	D4(7)	VIOLET	
18	ECLK1-	D4(8)	GRAY	
19	ED1+	D4(9)	WHITE	
20	ED1-	D4(10)	BLACK	
21	NC			
22	NC			
23	NC			
24	NC			
25	NC			
26	NC			

Note: Short two wires from F3(12) and P5(A24) at D5(10).

#### F4(ANALOG-IO)

PIN NO.	SIGNAL	LEV1	COLOUR
1	NC		
2	NC		
3	AZM1-CR	D5(20)	ORANGE
4	AZM2-CR	D5(21)	YELLOW
5	ELM1-CR	D6(20)	GREEN
6	ELM2-CR	D6(21)	BLUE
7	AZ1-TACO	D7(14)	VIOLET
8	AZ2-TACO	D7(15)	GRAY
9	EL1-TACO	D7(16)	WHITE
10	EL2-TACO	D7(17)	BLACK
11	AZ-POSPOT	D5(22)	BROWN
12	EL-POSPOT	D6(22)	RED
13	NC		
14	NC		
15	NC		
16	NC		
17	NC		
18	NC		

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19	AZ-ERR+	P9(C14)	WHITE
20	AZ-ERR-	D7(20)	BLACK
21	EL-ERR+	P9(A25)	BROWN
22	EL-ERR-	D7(22)	RED
23	NC		
24	NC		
25	NC		
26	NC		
27	NC		
28	NC		
29	NC		
30	NC		
31	NC		
32	NC		
33	NC		
34	NC		

## 2. SSC HARDWARE CONFIGURATIONS

### 2.1 JUMPER SETTINGS

The following jumpers should be closed. All other jumpers should be left open.

#### 2.1.1 CPU86X BOARD:

J2 1,2  
J2 11,12  
J3 3,4 onboard : 1 wait state  
offboard: xack\ only  
J4 3,4 reset on watchdog expiry  
J5 3,4  
J7 5,6  
J8 5,6  
J10 2 Channel A :RS232C  
J11 2 Channel B :RS232C  
J12 3,4  
J13 3,4  
J14 1,2  
J15 1,2  
Selects 32K RAM chips for group1  
and 64K EPROMs for group2.

short U36 4,5 for selecting application software  
open U36 4,5 for selecting monitor program.

#### 2.1.2 ENCODER BOARD:

J1 close Selects 8031  
J4 2 Port A is output  
J5 2 Port B is output  
J6A 2 U4 is ROM

#### 2.1.3 DIGITAL INPUT BOARD1:

B4 2,4,5,8 Board base address is 40.  
Close D5 2

#### **2.1.4 DIGITAL INPUT BOARD2:**

---

B4 1,4,5,8 Board base address is 50.  
Close D5 2

#### **2.1.5 ANALOG I/O BOARD:**

---

J1 close Selects 8031  
J4 3,4  
J4 7,8 Selects ADC range +-10V.  
J6A 1 : U4 is EEPROM

#### **2.1.6 TTL OUTPUT BOARD:**

---

D4 1,3,5,8 Board base address is 70.

#### **2.1.7 RELAY BOARD:**

---

None.

#### **2.1.8 ANGLE DISPLAY BOARD(AZIMUTH):**

---

J2 1,2 Selects board address 18H..1FH  
J3 close Selects normal mode(i,e. not blank test mode)  
J4 close Select auto shutoff feature.

#### **2.1.9 ANGLE DISPLAY BOARD(ELEVATION):**

---

J2 3,4 Selects board address 28H..2FH  
J3 close Selects no blank-test mode.  
J4 close Select auto shutoff feature.

#### **2.1.10 STATUS DISPLAY BOARD:**

---

J1 close Select no lamptest mode.  
J2 5,6 Selects board address 30H..37H  
J3 close Select no blank-test mode.  
J4 close Selects auto shutoff feature.

### 3. SSC OPERATIONS DETAILS

#### 3.1 SSC Digital outputs:

There are 16 relay outputs which are numbered on the relay board front panel as follows.

#### LED No.      Signal Name

L1	AZ-ON-OP
L2	-unused-
L3	-unused-
L4	AZ-STG
L5	AZ-CAGE
L6	AZ-POWER-ON
L7	-unused-
L8	EL-ON-IP
L9	EL-STOW
L10	EL-STRLS
L11	EL-SIG
L12	EL-CAGE
L13	EL-POWER-ON
L14	-unused-
L15	EM-PARK
L16	SSC-OK

#### 3.2 Status LED displays:

EL		AZ		SYS	
ENC	AOL	ENC	AOL	MAN	POS
RUN	STP	RUN		LOC	TRK
UPP	STD	CCP		REM	SLW
UPF	STR	CCF		AC	CWR
DNP	BK1	CP	BK1	DC	W50
DNF	BK2	CF	BK2	SSC	W80

##### 1) ENC: Encoder fault

This LED turns on whenever a parity error is detected in

the encoder reading. However the next correct reading (without the parity error) turns off the led.

2) RUN: Axis ON

This led is turned on when the axis is on. ie, when the digital input ax\_on\_ip is true.

3)UPP: Up Prelimit

This led is turned on when the software high limit is reached.

4)UPF: Up Finallimit

This led is turned on when the hardware high limit is reached.

5)DNL: Down Prelimit

This led is turned on when the software low limit is reached.

6)DNF: Down Finallimit

This led is turned on when the hardware low limit is reached.

7)AOL: Axis Overload

This led is turned on when either of the amplifiers are overloaded or either of the motors are overloaded( ie,motor thermostats opened) on the particular axis.

8)STP: Stow Position Reached

This led is always off for the azimuth axis. For the elevation axis this led is turned on when the stow position is reached as sensed by the stow position limit switch.

9)STD: Stowed

This led is always off for the azimuth axis. For the elevation axis this led is turned on when the axis is stowed as sensed by the stowed limit switch.

10)STR: Stow Released

This led is always off for the azimuth axis. For the elevation axis this led is turned on when the axis is stow released as sensed by the stow released limit switch.

11)BK1: Brake 1 applied

This led is on when the brake 1 is applied as sensed by the brake 1 contact input.

- 12)BK2: Brake 2 applied  
This led is on when the brake 2 is applied as sensed by the brake 2 contact input.
- 13)CCP: Counter Clockwise Prelimit  
This led is turned on when the software low limit is reached.
- 14)CCF: Counter Clockwise Final limit  
This led is turned on when the hardware low limit is reached.
- 15)CP: Clockwise Prelimit  
This led is turned on when the software high limit is reached.
- 16)CF: Clockwise Final limit  
This led is turned on when the hardware high limit is reached.
- 17)MAN: Manual mode  
This led is on when manual mode is selected by the system.
- 18)LOC: Local mode  
This led is on when local mode is selected by the system.
- 19)REM: Remote mode  
This led is on when remote mode is selected by the system.
- 20)AC: Ac Good  
This led is on when the 3 phase ac contactors of both the azimuth and elevatrion are closed.
- 21)DC: Dc Good  
This led is on when the 24V dc power supply is ok. ie,ps2\_ok.
- 22)SSC: SSC OK  
This led is on if the SSC self test is passed (ie,EEPROM checksum and RAM read write check and all cards exists etc) and no runtime h/w access error occurs(h/w card access error generates NMI)
- 23)POS: Positioning  
This led is on when either of the axis is in the positioning mode.(ie, when the position loop is active)
- 24)TRK: Tracking  
This led is on when either of the axis is in the tracking mode.(ie, when the position loop is active and the antenna is

tracking the target)

25)SLW: Slewing

This led is on when slewing (or emergency parking) is being carried out by external logic as sensed by the em-park1 input.

26)CWR: Cablewrap sign

This led is on when the cablewrap sign is positive on the azimuth axis.i.e, when the antenna is within a position range where it can move towards the clockwise position limits.

27)(W50: Wind velocity 1 High

This led is when either of the wind velocity low limits are reached.

28)W80: Wind velocity 2 High

This led is when either of the wind velocity high limits are reached.

### 3.3 Commands State table:

#### 3.3.1 AZ command list

Command	Accepted states	Final state
1.COLDSTART	RLSDBRKD	POSNING
2.HOLD	RLSDBRKD, POSNING, TRACKING	POSNING
3.STOP	POSNING, TRACKING , LMTRLSG	RLSDBRKD
4.POSITION	RLSDBRKD, POSNING	POSNING
5.TRACK	TRACKING, POSNING	TRACKING
6.ABORT	POSNING, TRACKING LMTRLSG	POSNING RLSDBRKD

#### 3.3.2 AZ state table

Commands	Interlock Conditions for the Success of the command	Next State
----------	-----------------------------------------------------------	------------

---

**1.RLSDBRKD state:**

---

b)HOLD/POSN /CLOSE /COLDSTART	flmt-cw=0, flmt-ccw=0 m-ol=0, a-ol=0, c-st=1 on-ip=1, brkd=0	POSNTNG
c)HOLD	flmt-cw=1 or flmt-ccw=1 m-ol=0, a-ol=0, c-st=1	LIMITRLSG

---

**2.LMTRLSG state:**

---

a)ABORT	-----	RLSDBRKD
---------	-------	----------

---

**3.POSNING state:**

---

a)HOLD/POSN/ABORT	-----	POSNING
b)STOP	-----	RLSDBRKD
c)TRACK	rem-ip=1 man-ip=0 loc-ip=0	TRACKING

---

**4.TRACKING state:**

---

a)HOLD/ABORT	-----	POSNING
b)STOP	-----	RLSDBRKD
c)TRACK	-----	TRACKIN

---

**3.3.3 EL command list**

---

Command	Accepted states	Final state
---------	-----------------	-------------

---

1.COLDSTART	STOWED	POSNING
2.HOLD	RLSDBRKD , POSNING , TRACKING	POSNING
3.STOP	POSNING , TRACKING , LMTRLSG	RLSDBRKD
4.POSITION	RLSDBRKD , POSNING	POSNING
5.TRACK	TRACKING , POSNING	TRACKING
6.ABORT	POSNING , TRACKING LMTRLSG	POSNING RLSDBRKD
7.CLOSE	RLSDBRKD	STOWED
8.STOW	RLSDBRKD , STOWERR	STOWED
9.STOWRELEASE	STOWED , STOWERR	RLSDBRKD

### 3.3.4 EL state table

Commands	Interlock Conditions for the Success of the command	Next State
1.STOWED state:		
a)STOWRELEASE	stwd=0,strlsd=1	RLSDBRKD
b)COLDSTART	stwd=0,strlsd=1 on-ip=1,brkd=0,c-st=1	POSNING
2.STOWERR state:		
a)STOW	stwd=1,strlsd=0	STOWED
b)STOWRELEASE	stwd=0,strlsd=1	RLSDBRKD

-----  
3. STOWING state:

No commands are acceptable in this state.

-----  
4. STOWRLSG state:

No command are acceptable in this state.

-----  
5. RLSDBRKD state:

a) STOW	stp-lmt=1 stwd=1, strlsd=0	STOWED
b) HOLD/POSN /CLOSE	flmt-cw=0, flmt-ccw=0 m-ol=0, a-ol=0 c-st=1 stwd=0, strlsd=1 on-ip=1, brkd=0	POSNING
c) HOLD	flmt-cw=1 or flmt-ccw=1 m-ol=0, a-ol=0 c-st=1 stwd=0, strlsd=1	LIMITRLSG
d) CLOSE	stp-lmt=1 stwd=1, strlsd=0	STOWED

-----  
6. LMTRLSG state:

a) ABORT	-----	RLSDBRKD
----------	-------	----------

-----  
7. POSNING state:

a) HOLD/POSN/ABORT	-----	POSNING
b) STOP	-----	RLSDBRKD
c) TRACK	rem-ip=1 man-ip=0 loc-ip=0	TRACKING

-----  
8. TRACKING state:

a)HOLD/ABORT	-----	POSNING
b)STOP	-----	RLSDBRKD
c)TRACK	-----	TRACKIN

### 3.4 HHT COMMANDS

The following modes of operation are supported on the Hand Held Terminal.

1. TEST MODE
2. DISPLAY MODE
3. COMMAND MODE
4. SET MODE

The TEST MODE is available only when the system mode is 'mode\_off'. The DISPLAY MODE is available in all the system modes. The COMMAND and SET MODES are available only in the 'local mode' of the system.

The first letter (T,D,C,S) which appear as prompt on hht gives an indication of the current operating mode. eg, T> In the TEST MODE a few offline diagnostics can be invoked. In the Display mode all the system variables of interest are displayed. In the Command mode the operational commands of system are accepted and responses are echoed. The Set mode includes various parameter setting commands.

#### 3.4.1 TEST MODE COMMANDS:

SL_NO	COMMAND	SYNTAX	DESCRIPTION
1.	ROM TEST	O	Checks the EEPROM checksum
2.	RAM TEST	A	RAM read/write test
3.	HOSTLINK TEST	H	Sends check link cmd to host
4.	ENCODER TEST	E	Displays raw encoder readings
5.	DISPLAY TEST	D	A test pattern on disp LEDS.
6.	ANALOG I/P TEST	I,A/m	
7.	ANALOG O/P TEST	P,S/F[,xx.xx]	
8.	DIGITAL I/P TEST	G	
9.	DIGITAL O/P TEST	R,A/n	
10.	LIST VALID COMMANDS	L	

## 11.CHANGE MODE

M,(S/T/C/D)

## Abbreviations used:

m= anlg/ip channel number= [0..11]  
 S= sawtooth waveform  
 F= fixed voltage o/p  
 n= dgtl o/p channel number= [0..15]

## 3.4.2 SET MODE COMMANDS:

SL_NO	COMMAND	SYNTAX
1.	SET TIME OF DAY	T, hh:mm:ss, dd-mm-yy
2.	SET SOFT LOW LIMITS	P, (A/E/B), ang1[,ang2]
3.	SET SOFT HIGHLIMITS	H, (A/E/B), ang1[,ang2]
4.	SET WIND VEL LIMITS	W, vel1, vel2
5.	SET HOST COMM PARM	C, baudrate, parity, bits, stopbits
6.	SET LOOP PARMS	K, (A/E), [G11=xxx.xx, T11=xxx.xx, ...]
7.	SET STOW POSN(EL)	S, ang1
8. 	SET ENCODER OFFSET	E, axis, ang1[,ang2]
9.	SET DISPLAY MODE	D, display_mode
10.	SET CONTROL TYPE	Y, (A/E), (1/2)
11.	SET CURRENT LIMITS	I, az_limit, el_limit
12.	SET SPEED LIMITS	N, az_limit, el_limit
13.	SET AUX_DAC0 MODE	A, aux_mode
14.	SET AUX_DAC1 MODE	B, aux_mode
15.	SET STATION NUMBER	Z, xxx
16.	LIST VALID COMMANDS	L
17.	CHANGE HHT MODE	M, (S/T/C/D)

## Abbreviations used:

ang1= +/-ddd:mm:ss  
 ang2= similar to ang1  
 vel1=xx in KMPH  
 vel2= similar to vel1  
 display\_mode= (W/T/E/P/O)  
     where W= wind velocity in KMPH  
     T= Target angle in DD:MM:SS  
     E= Error angle in DD:MM:SS  
     P= Pot position in DD:MM:SS  
     O= all displays off  
 aux\_mode= (C0/C1/T0/T1/E0/E1/W0/W1)  
     where C= Current angle  
     T= Target angle

E= Error angle  
 W= Wind velocity.  
 subscript 0 means AZ axis.  
 subscript 1 means EL axis.  
 for all angles the span is:  
 $\pm 90:0:0 \Rightarrow \pm 10$  Volts  
 for wind velocity the span is:  
 100 KMPH  $\Rightarrow 10$  Volts. —— —

parity= (O/E/N)

#### 3.4.3 DISPLAY MODE COMMANDS:

SL_NO	COMMAND	SYNTAX
1.	SYSTEM STATUS	S
2.	ANTENNA STATUS	A
3.	DRIVE STATUS	D
4.	POSITION STATUS	P
5.	INTERLOCK STATUS	I
6.	SYSTEM VARS	V
7.	SYSTEM LIMITS	T
8.	LIST VALID COMMANDS	L
9.	CHANGE HHT MODE	M, (S/T/C/D)

#### 3.4.4 COMMAND MODE:

SL_NO	COMMAND	SYNTAX
1.	DRIVE STOW	D, (A/E/B)
2.	RELEASE STOW	R, (A/E/B)
3.	STOP	S, (A/E/B)
4.	POSITION	P, (A/E/B), ang1[, ang2]
5.	ABORT	A
6.	HOLD	H, (A/E/B)
7.	CLOSE	C
8.	INIT COLDSTART	I
9.	TRACK	T, (A/E/B), time, ang1[, ang2]
9.	LIST VALID COMMANDS	L
10.	CHANGE HHT MODE	M, (S/T/C/D)

Abbreviations used:

ang1= +/-ddd:mm:ss  
 ang2= similar to ang1

time= hh:mm:ss

### 3.5 HOST COMMANDS AND RESPONSES

#### 3.5.1 Introduction:

The various commands accepted from the Station Control Computer(SCC) can be classified into the following groups.

1. Operational Commands.
2. Display commands.
3. Set Mode Commands.

The syntax of the various command parameters are as follows.

- |                          |                                                                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. ax -> A/E/B           | A=azimuth,E=elevation,B=both.                                                                                                                                          |
| 2. time -> hh:mm:ss      | hh=hours,mm=minutes,ss=seconds<br>2 colons are a must, but each field should have atleast one character. e.g., Time= 0:0:0                                             |
| 3. date -> dd-mm-yyyy    | dd=date,mm=month,yyyy=year<br>2 hyphens are a must, but each field should have atleast one character.<br>e.g., date=1-01-1989                                          |
| 4. angl -> +/-ddd:mm:ss  | ddd=degs,mm=mins,ss=secs.<br>2 colons are a must, but each field should have atleast one character. ie,angl = -123:50:10<br>The sign is optional. Default sign is +ve. |
| 5. ang2 -> +/-ddd:mm:ss  | ang2 is required only if axis specified is B(both).<br>syntax is similar to angl.<br>e.g., 050 or 50                                                                   |
| 6. vel1 -> xxx           | e.g., 080 or 80                                                                                                                                                        |
| 7. vel2 -> xxx           | e.g., 40 (in Amps)                                                                                                                                                     |
| 8. az_cur,el_cur -> xxx  | e.g., 1500 (in RPM)                                                                                                                                                    |
| 9. az_spd,el_spd -> xxxx |                                                                                                                                                                        |

All the parameters should be in ASCII form and the parameters should be separated by comma(s).

#### 3.5.2 OPERATIONAL COMMANDS:

The various operational commands are listed below.

SL_NO	COMMAND	SYNTAX	DESCRIPTION
1.	Coldstart	40H	Stow releases and holds the axes in the current positions. Coldstart= (stwrls+hold)
2.	Position	42H,ax,ang1[,ang2]	Positions the specified axis to the specified position(s).
3.	Track	44H,ax,time,ang1[,ang2]	Tracks the specified axis so as to reach the target position(s) at the specified time.
4.	Hold	46H,ax	Holds one or both the axis at the current position.
5.	Stop	48H,ax	The drives are turned off and brakes are applied to one or both the axis.
6.	Close	4aH	Turns off the drive and parks the antenna.
7.	Stow	4cH,ax	Drives the specified axis to the stow position.
8.	Stow release	4eH,ax	Releases the stow on the specified axis.
9.	Abort	50H	Aborts the previous command undertaken if any.
10.	H/W reset SSC	5CH	Issues Hardware reset command to the SSC.

8/3/95

Ref Source calc

15/5/99  
difference  
this can be

manual from  
is that MAIN R/T  
action is by longer  
duration; disp

For each of the operational commands the SSC sends an IMMEDIATE RESPONSE frame from the application layer which indicates whether the command issued is accepted or not.(ie, an ACCEPTED frame or a NOT ACCEPTED frame ).This is in addition to the link level ACK/NAK frames exchanged between the communication layers on SSC and SCC.

If the command is not accepted then the response frame also includes 1 byte code indicating the reasons for failure. If the command is accepted then a FINAL RESPONSE is sent when the command terminates indicating the success or failure or abort.

A few response messages(events) are also sent by the SSC when some events occur at the SSC. For these events the SSC expects only a link level ack. (ie, the application layer need not send an user-level ACCEPTED frame.) The FINAL RESPONSE also goes as an event to the SCC.

### 3.5.2.1 IMMEDIATE RESPONSES:

RESPONSES	CODE	DESCRIPTION
1. ACCEPTED	10H	Data string of this frame contains only one byte code hex 10.
2. NOT ACCEPTED	11H	Data string of this frame contains 2 bytes,hex 11 followed by one of the FAIL REASONS byte defined below.

FAIL REASONS	CODE
(a) CMD TIME-OUT	51H
(b) IRRELEVANT CMD	52H
(c) SYNTAX ERROR	53H
(d) ILLEGAL CMD	54H

### 3.5.2.2 FINAL RESPONSES AND EVENTS:

These frames contain the following bytes.

event code :12H

event number :HEX,

#### (a) Axis dependent events:

SL_NO	EVENT	AZ CODE	EL CODE
-------	-------	---------	---------

SL No	Event	A2 code	E1 code
1.	CMD SUCCESSFUL	10H	11H
2.	CMD FAILED	12H	13H
3.	CMD ABORTED	14H	15H
4.	STOW ERROR	---	21H
5.	STOWED	---	23H
6.	STOW RELEASED	---	25H
7.	STOWING	---	27H
8.	STOW RELEASING	---	29H
9.	STOW POSITION REACHED	---	2BH
10.	AXIS INTERLOCKED	2CH	2DH
11.	AXIS ON	2EH	2FH
12.	AXIS OFF	30H	31H
13.	CW LIMIT REACHED	32H	33H
14.	CCW LIMIT REACHED	34H	35H
15.	LIMIT EXITED	36H	37H
16.	MOTOR CURRENTS HIGH	38H	39H
17.	MOTOR SPEEDS HIGH	3AH	3BH
18.	TRACK QUE DISCARDED	3CH	3DH
19.	AXIS FAULT	3EH	3FH

(b) Axis independent events:

SL_NO	EVENT	CODE
1.	WIND VEL HIGH	50H
2.	EMERGENCY PARK STARTED	51H
3.	SYSTEM MODE CHANGED	52H
4.	SSC RESET OCCURRED	53H
5.	SSC NOT OK	54H

3.5.3 DISPLAY COMMANDS:

The possible responses for these commands are the requested data packet or a NOT ACCEPTED frame. The NOT ACCEPTED frame includes the reason for the failure of the command.

SL_NO	COMMANDS	SYNTAX	DESCRIPTION
1.	Read angles	30H	sends current positions ,target positions,pot positions.

The various parameters sent by SSC are arranged in the

following order and comma is the delimiter.

```
angles response code:31H
time of day      :time,
az current position (CP) :ang1,
az target position (TP) :ang1,
az pot position (PP) :ang1,
el current position (CP) :ang1,
el target position (TP) :ang1,
el pot position (PP) :ang1,
```

2. Read Analog Vars      32H      sends a data packet containing all analog variables

The various parameters sent by SSC are arranged in the following order and comma is the delimiter.

```
analog response code:33H
time of day      :time,
az motor1 current :xxxx.xx,      in amps e.g., 35.12 Amps.
az motor2 current :xxxx.xx,      in amps e.g., 34.1234 amps.
az tacho1        :xxxxx.x,       in RPM e.g., 987 RPM
az tacho2        :xxxxx.x,       in RPM e.g., 1023 RPM
el motor1 current :xxx.xx,       in amps e.g., 35.12 Amps.
el motor2 current :xxx.xx,       in amps e.g., 34.1234 amps.
el tacho1        :xxxxx.x,       in RPM e.g., 987 RPM
el tacho2        :xxxxx.x,       in RPM e.g., 1023 RPM
wind vel1         :vel1,         in KMPH e.g., 63 KMPH
wind vel2         :vel1,         in KMPH e.g., 63 KMPH
```

3. Read Digital Vars      34H      sends a data packet containing all the digital variables.

The various parameters sent by SSC are arranged in the following order and comma is the delimiter. The first byte \$35 is the digital data response code which is followed by the time of day. The next 6 bytes contain the status of various digital variables. Out of the 6 status bytes the first 2 bytes contain elevation axis status, the next 2 bytes contain azimuth axis status and the last 2 bytes contain system status.

```
byte 0= dgtr response code: 35H
time of day(bytes 1 to n) : time,
```

	d0(1sb)	d1	d2	d3	d4	d5	d6	d7(msb)
byte n+1 :ENC	RUN	UPP	UPF	DNP	DNF	AOL	STP,	
byte n+2 :STD	STR	BK1	BK2	X	X	X	X,	
byte n+3 :ENC	RUN	CCP	CCF	CP	CF	AOL	X,	
byte n+4 :X	X	BK1	BK2	X	X	X	X,	
byte n+5 :MAN	LOC	REM	AC	DC	SSC	POS	TRK	
byte n+6 :SLW	CWR	W50	W80	X	X	X	X,	

All the variables are active high. ie, BK1=1 if brake1 is applied. Please refer to section 3.2 of this manual for the description of each of these boolean variables.

4. Read set parameters: 36H sends loop parameters, offset angles etc.

The various parameters sent by SSC are arranged in the following order and comma is the delimiter.

```

set parameters response code:37H
time of day           :time,
wind vel low limit   :vel1,          e.g.,50 in KMPH
wind vel high limit  :vel1,         e.g.,80 in KMPH
az stow angle         :ang1,
az soft low limit    :ang1,
az soft high limit   :ang1,
az encoder offset    :ang1,
az G11                :xxx.xx,      e.g.,010.50
az T11                :xx.xx,        e.g.,11.23
az T12                :xx.xx,
az T13                :xx.xx,
az G21                :xxx.xx,
az T21                :xx.xx,
az T22                :xx.xx,
az T23                :xx.xx,
el stow angle         :ang1,
el soft low limit    :ang1,
el soft high limit   :ang1,
el encoder offset    :ang1,
el G11                :xxx.xx,
el T11                :xx.xx,
el T12                :xx.xx,
el T13                :xx.xx,
el G21                :xxx.xx,
el T21                :xx.xx,

```

```
el T22 :xx.xx,  
el T23 :xx.xx,
```

NOTE: The transfer functions for TYPE I and TYPE II. controls are as follows:

TYPE I :  $(G_{11} (1+ T_{11} s)) / ((1+T_{12} s) (1+T_{13} s))$

TYPE II:  $(G_{21} (1+ T_{21} s) (1+ T_{22} s)) / ( s(1+ T_{23} s))$

where G's are the position loop gains and T's are the position loop time constants of the compensator. The first subscript denotes the type of the system.

5. Read antenna states: 38H sends antenna states(ascii string)  
antenna state response code :39H  
time of day :time,  
az\_state :string,  
el\_state :string,  
e.g., 'RLSDBRKD'  
e.g., 'TRKG'

6. Read version,station no  
and selftest result : 3AH sends the software version number and the SSC station number and selftest result.  
version response code :3BH  
version number :string, e.g., '1.4'  
station number :string, e.g., 'C03'  
selftest result :string, e.g., '0'

NOTE: Selftest results are listed below.

D7 D6 D5 D4 D3 D2 D1 D0	
0 0 0 0 0 0 0 0	=00 =SSC OK (No errors)
0 0 0 0 0 0 1 0	=01 =EEPROM Checksum Error
0 0 0 0 0 1 0 0	=02 =RAM Readwrite Error
0 0 0 0 1 0 0 0	=04 =TTL_OP board h/w fault
1 0 0 x x x x	= All cards are not existing; D0=1 if P3(slot 3) is absent; D0=0 if P3 is present Similarly bit D1 for P4, D2 for P5, D3 for P6, D4 for P7.

### 3.5.4 SET MODE COMMANDS:

The possible responses from the SSC for these commands are

- (a) The current set values of the parameters from the application layer which indicates that the specified set command is executed.
- (b) NOT ACCEPTED frame containing the reasons for failure.

SL_NO	COMMANDS	SYNTAX	RESPONSE
1.	Set Time Of Day	52H,time,date	53H,time,date
2.	Set Stow Angle	54H,ang1	55H,ang1
3.	Set S/W Hi Limit	56H,ax,ang1[,ang2]	57H,ang1[,ang2]
4.	Set S/W Lo Limit	58H,ax,ang1[,ang2]	59H,ang1[,ang2]
5.	Set Windvel Limits	5AH,vel1,vel2	5BH,vel1,vel2
6.	Set Current Limits	5CH,az_cur,el_cur	5DH,az_cur,el_cur
7.	Set Speed Limits	5EH,az_spd,el_spd	5Fh,az_spd,el_spd

Version no: 1.25

This manual updated on: 22-12-1992

Note:

1. The response for the 'Read set parameters' command is modified to include 2 more parameters AZ T12 and EL T12.
2. Two set mode commands are added (ie, set current limits and speed limits for motors).

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