PS/RF/NOTE 86-2
BJE/gm - 10.1.1986

SIGNALS FOR THE CPS 114 MHZ RF SYSTEM

M. Croizat, B.J. Evans, R. Garoby, R. Hohbach

INTRODUCTION

A new 114 MHz RF system is to be installed in the CPS to accelerate electrons and positrons in the LEP chain. Two cavities (one in Straight Section 4, the other in SS 10) will be driven by high-power amplifiers from building 151 to provide the required 1 MV accelerating voltage. Figure 1 shows the interconnections needed to control and monitor the complete system. All the low-level RF processing will take place in the Central Building from which drive signals for the two chains will be obtained. Special precautions (e.g. the Faraday Cage shown) have been taken to ensure very low 114 MHz leakage due to the proximity of Cointrin Airport and its ILS operating at almost the same frequency.

The following tables define the signals to be passed between the various locations and also, where applicable, the type of cable to be used.

Appendix 1 shows the total number of cables to be laid down between B-353 and B-151 while Appendix 2a shows the hardware to be controlled by the MCR and 2b the appropriate timing pulses.

Connections from CB (353) to B-151

Analogue

DESCRIPTION	CHARACTERISTIC	USE	CABLE
114 MHz RF Signal	114.4 → 114.6 MHz 10 dBm, 50 Ω	Power Amp. Drive	SCK 50
114 MHz Cavity	α Phase (~ 35 mV/1°)	Cavity Tuning (Fast Tuner)	Screened Pair
	Tuning		SCEM 04.21. 51.055.4
114 MHz RF	---	Spare	SCK 50
Miscellaneous	---	Observation/ Control	4xRG-214
Amplifier Matching	0 → 10 V DC Level for Analogue Servo System	Matching for Pulse/CW (Control and Status)	2xScreened Twisted Pair (9x2)

Total = 2 SCK 50 Co-axial Cables
4 RG-214 Co-axial Cables
1 Screened Twisted Pair Cable (1x2)
2 Screened Twisted Pair Cables (9x2)

CB to B-151 Cavity Rack

Digital

DESCRIPTION	CHARACTERISTIC	USE	CABLE
Level 1 ON	Pulse TTL open collector	Control	M/c*
Level 1 OFF	"	"	M/c
Level 2 ON	"	"	M/c
Level 2 OFF	"	"	M/c
Ring Vacuum OK	TTL Logic Level (Open Collector)	Status Indication	M/c
Ring Door OK	"	"	M/c
Reset	Pulse TTL open collector	Control	M/c
Gap short-circuit ON	Blocking Osc.	"	RG-214
Gap short-circuit OFF	Blocking OSC.	"	RG-214
Timing Pulses (4)	Blocking Osc.	General (Scope Trigger-ing etc.)	4xRG214
114 MHz Cavity Tuning	PWM pulses	Cavity Tuning (Piston Tuner)	Screened Layer Twisted SCEM 04.21.51.104

(* M/c = One pair of multiconductor screened twisted pair cable)

Total = 7 Pairs in Multiconductor Cable
6 RG-214 Co-axial Cables
1 Screened Layer Twisted Cable

Connections from B-151 to B-353

Analogue

DESCRIPTION	CHARACTERISTIC	USE	CABLE
RF Amp. Forward	Sine 10 dBm, 50 Ω	Cavity Control	SCK 50
RF Amp. Reverse	Sine 10 dBm, 50 Ω	Observation	SCK 50
RF Cavity Probe	Sine 10 dBm, 50 Ω	Cavity Control	2xSCK 50
RF Amp.For.Detected	0 → 10 V DC level	Observation	RG-214
RF Amp.Rev.Detected	0 → 10 V DC level	Observation	RG-214
I_A Final	0 → 10 V DC level	Observation	RG-214
V_A Final	0 → 10 V DC level	Observation	RG-214
I_{G2} Final	0 → 10 V DC level	Observation	RG-214
Gap Inhibit	----	Observation	RG-214
Ferrite Tuner	α current	Observation	RG-214

Total = 4 SCK 50 Co-axial Cables
7 RG-214 Co-axial Cables

Connections from B-151 Cavity Rack to B-353 (continued)

Digital

DESCRIPTION	CHARACTERISTIC	USE	CABLE
Level 1 ON	TTL Logic Level (open collector)	Acquisition	1xMc
Level 1 OFF	"	"	"
Level 2 ON	"	"	"
Level 2 OFF	"	"	"
LOCAL Control	"	"	"
REMOTE Control	"	"	"
Tuning OK	"	"	"
Tuning Fault	"	"	"
Tuning Loop Open	"	"	"
Tuning Loop Closed	"	"	"
Tuning CW/Pulse OK	"	"	"
Tuning CW/Pulse Fault	"	"	"
Gap short-circuit ON	"	"	"
Gap short-circuit OFF	"	"	"
Mains Power Fault	"	Alarm	"
HT Fault	"	"	"
Cooling Fault Amplifier	"	"	"
Cooling Fault Cavity	"	"	"
Amplifier Fault	"	"	"
Door Fault/RF Interference	"	"	"
Stepper Motor Position	Serial Data Link	Acquisition	2xTwisted Pair

Total = 20 Pairs in Multiconductor Cable

1 Screened Twisted Pair Cable (2x2)

A P P E N D I X 1

Cables between B-353 and B-151 (CB Use only)

DESCRIPTION	QUANTITY	NOTES
Co-axial Cable Type SCK 50	12	Low loss/low tempco
Co-axial Cable Type RG-214	34	Double Screened
Screened Layer Twisted	2	SCEM 04.21.51.104.2
Screened Twisted Pair (1x2)	2	SCEM 04.21.51.055.4
" " " (9x2)	4	Amplifier Matching
" " " (2x2)	2	Stepper Motor Acquisition
Screened Twisted Pair	2	Minimum 27x2 required per cable
Co-axial Cable Type RG-214/U	2	75 Ω Video Cable for Observation

This is the total number of cables needed to control both cavities.

A P P E N D I X 2a

Hardware to be controlled by MCR

FUNCTION DESCRIPTION	HARDWARE
Cavities Relative Phasing	GFA
Cavity Voltage Program	FFG* (FFGVMD3)
Tuning Phase Discri. Offset	Hybrid Single Transceiver
RF Centre Frequency Control Word	Dual Output Register
Cavity Control/Status Acquisition	2 x Single Transceivers
Gap Voltage Measurement	Scanning ADC with MTIM*
Frequency Counter	GPIB*
Beam Steering	GFA*

* Re-use of existing hardware

A P P E N D I X 2b

Timing pulses from MCR

DESCRIPTION	QUANTITY	GROUP	NOTES
GFA Starts	3		3 Starts for Relative Phasing (= 1 Master, 2 Delays)
e^+ Selection	1	Particle Type	
Start Phase Lock at Injection	1	Harmonic Number	
Divider Reset at Injection	1	"	
e^+/e^- Injection Switching	1	"	
Beam Phase Loop ON	1	User	
Beam Phase Loop OFF	2	User	
Master Start Synch. on SPS	1	Harmonic Number	
Divider Reset at Ejection (1)	1	User	To be cascaded from Master Start Synch. on SPS
Start Synch. on SPS (1)	1	"	
Start Source Looking (1)	1	"	
Stop Synch. on SPS	1	"	
Divider Reset at Ejection (2)	1	User	To be cascaded from Master Start Synch. on SPS
Start Synch. on SPS (2)	1	"	
Start Source Locking (2)	1	"	
Gap Short-Circuit OFF	2	Next particle/ next user	2nd pulse to be cascaded from 1st
e^+/e^- M.D.	4		

Distribution:

Baconnier Y. (PSR)
Benincasa G.P. (CO)
Bobbio P.
Boillot J. (OP)
Brouzet E.
Cappi R.
Nassibian G.
Riunaud J.P.
Roux G.
Sayers I.
Schipper J.
Terrier J.P.

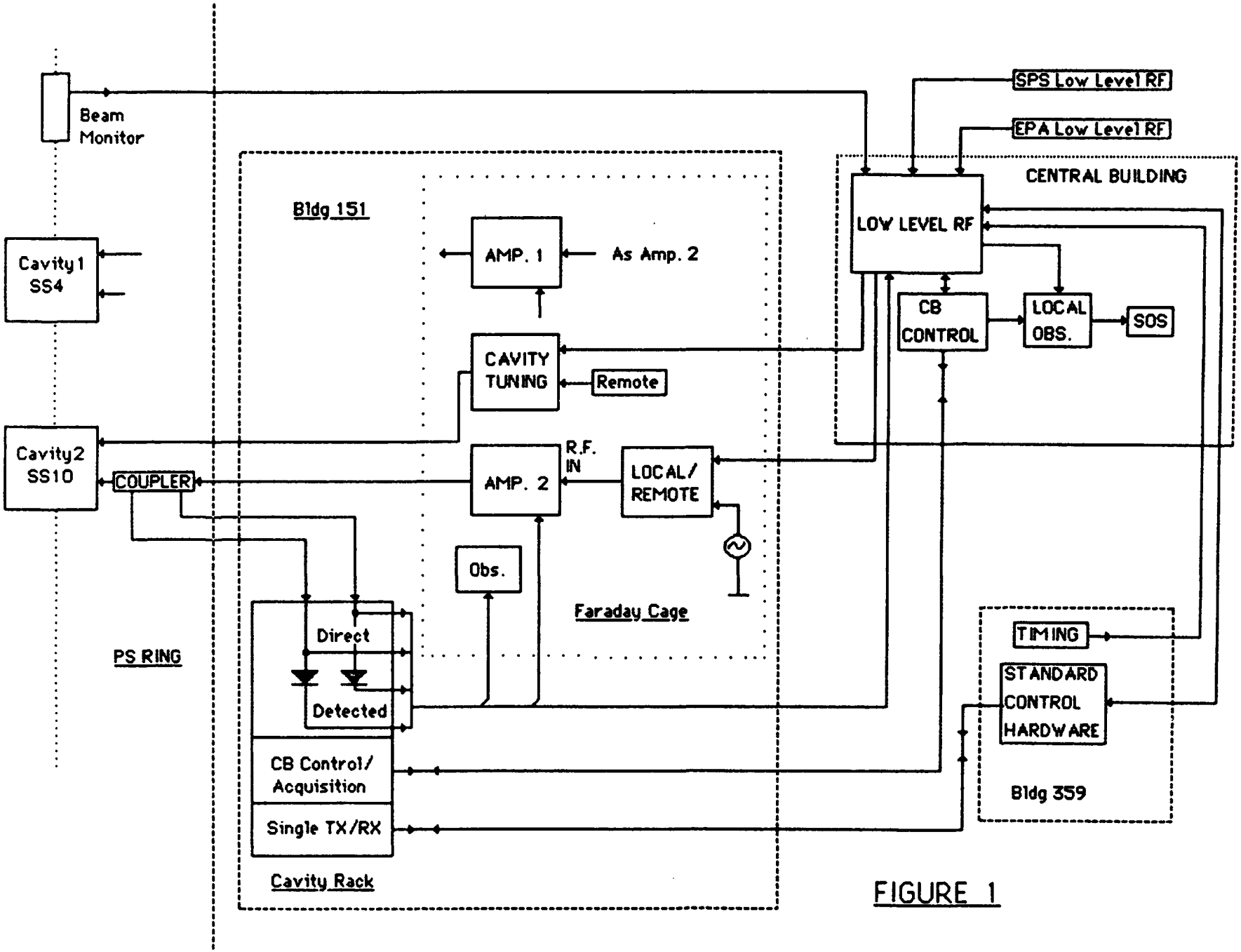
Beam Monitor
SPS Low Level RF
EPA Low Level RF
CENTRAL BUILDING
Bldg 151
LOW LEVEL RF
AMP. 1
As Amp. 2
Cavity1 SS4
CB CONTROL
LOCAL OBS.
SOS
CAVITY TUNING
Remote
Cavity2 SS10
COUPLER
AMP. 2
R.F. IN
LOCAL/ REMOTE
Obs.
Faraday Cage
PS RING
Direct
Detected
TIMING
STANDARD CONTROL HARDWARE
Bldg 359
CB Control/ Acquisition
Single TX/RX
Cavity Rack

FIGURE 1