

***KB9224***  
*PRELIMINARY*  
*DATA SHEET*  
1999.6.7

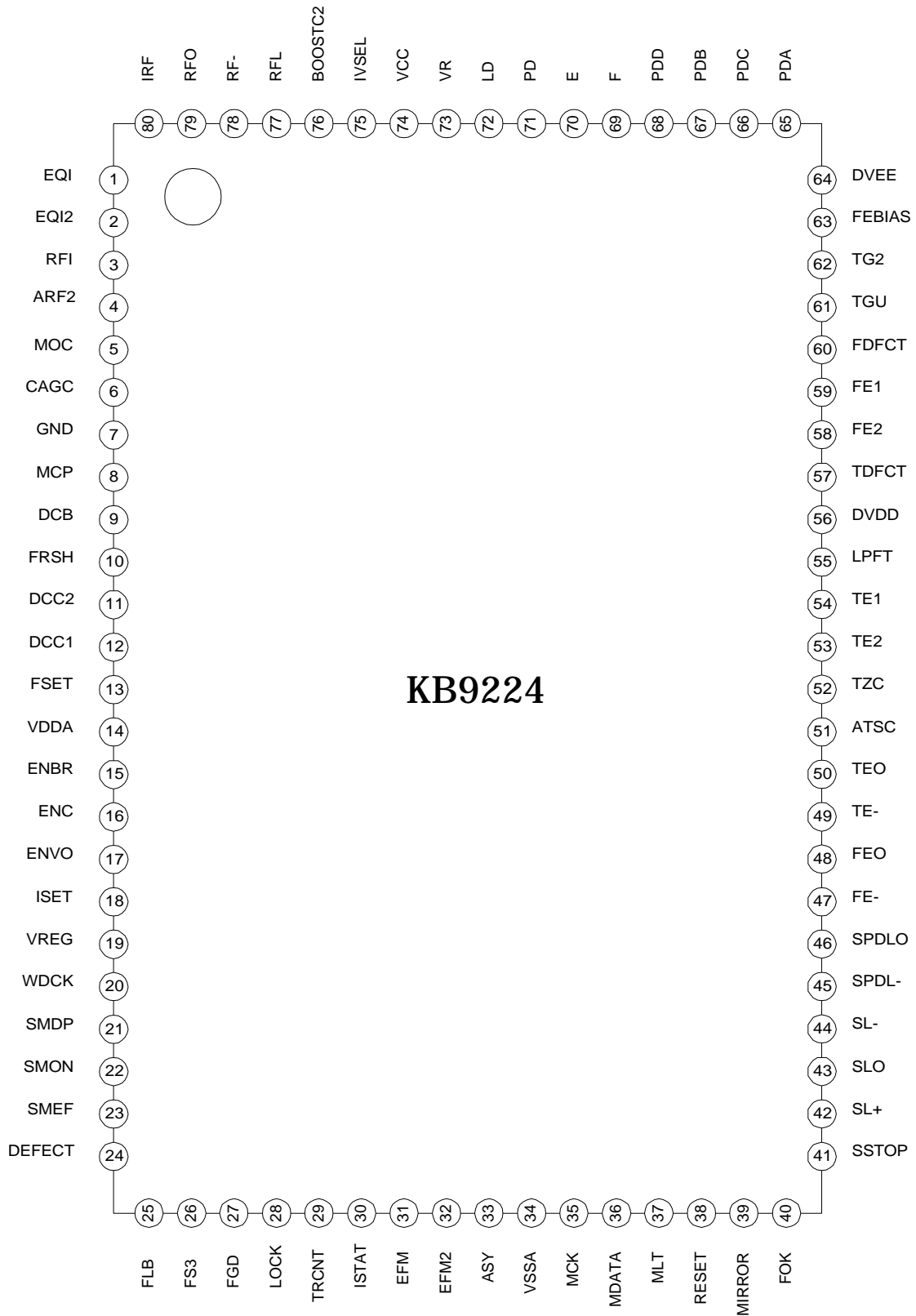
## INTRODUCTION

The KB9224 is a Servo Signal Processor designed specifically for the Samsung Video-CD designed using the BICMOS process. RF Block and Picture Quality Enhancing Items are built-in. The processor is a Hard-wired Free-Adjustment Servo with the Pre-signal parts adjustment point automatically adjusted.

## FEATURES

- Focus Error Amplifier & Servo Control
- Tracking Error Amplifier & Servo Control
- Sled Amplifier
- Embedded CLV Control LPF
- APC (Auto Laser Power Control) Circuit for Constant Laser Power
- Double Speed Play Available
- Circuit for Interruption Countermeasure
- Mirror, FOK & Defect Detector Circuit
- FE Bias & Focus Servo Offset Free Adjustment
- EF Balance & Tracking Loop Gain Free Adjustment
- Tracking Servo Offset Free Adjustment
- Enhanced Auto-Sequence Algorithm (Fast-Search)
- Tracking Mutting by Window Mirror
- Current, Voltage Pick-up Interaction available
- Embedded RF 3T Boost Circuit
- Enhanced RF Equalize AGC Circuit
- Built-in Envelope EFM Slicer
- Built-in DSP C1-flag Control Circuit
- RF Peaking Prevention Circuit
- Focus & Tracking mutting by EFM Duty Countermeasure
- Built-in Focus, Tracking 2x Filter Adjust
- Single Power Supply: +5 V
- Related Products
  - . KS9287 Data Processor
  - . KA9258D/KA9259D Motor Driver

PIN CONFIGURATION



## PIN DESCRIPTION

No.	Pin Name	I/O	Description
1	EQI	I	RF AGC & Equalize input pin
2	EQI2	I	RF AGC & Equalize input connect switch (controled by Flag)
3	RFI	I	EFM COMPARATOR input pin
4	ARF	O	RF AGC & EQ output pin.
5	ARF2	O	RF AGC & EQ output connect pin (controled by Falg)
6	CAGC	I	AGC_EQUALIZE LEVEL control pin, VCA input pin & NOISE eliminating CAP pin
7	GND	G	Ground (RF block)
8	MCP	I	Half-wave rectifier CAP pin for MIRROR output
9	DCB	I	DEFECT MAX DUTY limiting CAP pin
10	FRSH	I	FOCUS SEARCH generating & charge/discharge CAP pin
11	DCC1	O	DEFECT MIN DUTY generating DC eliminating CAP pin. (connected DCC1)
12	DCC2	I	DEFECT MIN DUTY generating DC eliminating CAP pin (connected DCC2)
13	FSET	I	FCOUS,TRACKING,SPINDLE PEAKING frequency compensation BIAS pin
14	VDDA	P	5V POWER pin for SERVO
15	ENBR	I	BIAS pin for ENVELOPE EFM-SLICE
16	ENC	I	RF ENVELOPE DC BIAS extract voltage input pin
17	ENVO	O	RF ENVELOPE output pin
18	ISET	I	FOCUS SERARCH,TRACKING JUMP, SLED KICK voltage generating BIAS pin
19	VREG	O	3.4 V REGULATOR output pin
20	WDCK	I	88.2KHz input pin from DSP
21	SMDP	I	SMDP input pin of DSP
22	SMON	I	SMON input pin of DSP
23	SMEF	I	External LPF time constant connection pin of CLV servo error signal
24	DEFECT	O	DEFECT output pin.
25	FLB	I	CAP pin for FOCUS LOOP rising low band
26	FS3	I	FOCUS LOOPs high frequency gain adjustment pin
27	FGD	I	FOCUS LOOPs high frequency gain adjustment pin
28	LOCK	I	SLED RUN AWAY preventing pin (L: Sled Off and Tracking Gain Up)
29	TRCNT	O	Track Count output pin
30	ISTAT	O	INTERNAL STATUS output pin
31	EFM	O	RFO SLICE EFM output pin (to DSP)

**PIN DESCRIPTION** (Continued)

No.	Pin Name	I/O	Description
32	EFM2	O	EFM comparator integrating output pin
33	ASY	I	AUTO asymmetry control input pin
34	VSSA	G	SERVO part analog VSSA power supply PIN
35	MCK	I	MICOM clock pin
36	MDATA	I	DATA input pin
37	MLT	I	DATA LATCH input pin
38	RESET	I	RESET input pin
39	MIRROR	O	MIRROR detect output pin
40	FOK	O	FOCUS OK output pin
41	SSTOP	I	PICK UP's maximum lead-in diameter position check pin
42	SL+	I	SLED SERVO non-inverting input
43	SLO	O	SLED SERVO output
44	SL-	I	SLED SERVO inverting input
45	SPDL-	I	SPINDLE AMP inverting input pin
46	SPDLO	O	SPINDLE AMP output pin
47	FE-	I	FOCUS SERVO AMP inverting input pin
48	FEO	O	FOCUS SERVO AMP output pin
49	TE-	I	TRACKING SERVO AMP inverting input pin
50	TEO	O	TRACKING SERVO AMP output pin
51	ATSC	I	ANTI-SHOCK input pin
52	TZC	I	TRACKING ZERO CROSSING input pin
53	TE2	I	TRACKING SERVO input pin
54	TE1	O	TRACKING ERROR AMP output pin
55	LPFT	I	TRACKING ERROR integrating input pin (Auto adjust)
56	DVDD	P	LOGIC DVDD power supply pin
57	TDFCT	I	DEFECT TRACKING ERROR integrating CAP connection pin
58	FE2	I	FOCUS SERVO input pin
59	FE1	O	FOCUS ERROR AMP output pin
60	FDCT	I	When DEFECT, FOCUS ERROR integrating CAP connection pin
61	TGU	I	High frequency TRACKING GAIN SWITCHING CAP connection pin
62	TG2	I	Time constant controlling TRACKING LOOP's high frequency gain control pin
63	FEBIAS	I	FOCUS ERROR BIAS control connect pin

**PIN DESCRIPTION** (Continued)

No.	Pin Name	I/O	Description
64	DVEE	G	LOGIC DVEE power supply pin
65	PDA	I	POTO-DIODE A & RF I/V AMP1 inverting input pin
66	PDC	I	POTO-DIODE C & RF I/V AMP1 inverting input pin
67	PDB	I	POTO-DIODE B & RF I/V AMP2 inverting input pin
68	PDD	I	POTO-DIODE D & RF I/V AMP2 inverting input pin
69	F	I	POTO-DIODE F & TRACKING (F) I/V AMP inverting input pin
70	E	I	POTO-DIODE F & TRACKING (E) I/V AMP inverting input pin
71	PD	I	APC AMP input pin
72	LD	O	APC AMP output pin
73	VR	O	(VCC+GND)/2 VOLTAGE REFERENCE output pin
74	VCC	P	RF PART VCC power supply pin
75	IVSEL	I	Pick-UP Type Select pin(Default Pull Down)
76	BOOSTC2	I	RF SUMMING AMP 3T BOOST's CAP connection pin (connected GND)
77	RFL	I	RF SUMMING AMP NOISE eliminating CAP connection pin (connected RFO)
78	RF-	I	RF SUMMING AMP inverting input pin
79	RFO	O	RF SUMMING AMP output pin
80	IRF	I	RFO DC eliminating input pin (Used in MIRROR, FOK pin)

**MICOM COMMAND**

(\$0X, \$1X)

Item	Address	Data				ISTAT Output
	Symbol	D3	D2	D1	D0	
Focus Control	0 0 0 0	FS4 Focus On	FS3 Gain Down	FS2 Search On	FS1 Search Up	FZC
Tracking Control	0 0 0 1	Anti-Shock	Brake On	TG2 Gain Set	TG1 Gain Set	ATSC

**Tracking Gain Setting for Anti-Shock**

D7	D6	D5	D4	D3		D2		D1		D0		ISTAT Output
				Anti-Shock		Lens. Brake		TG2 (D3=1)		TG1		
				0	1	0	1	0	1	0	1	
0	0	0	1	Anti-Shock Off	Anti-Shock On	Lens Brake Off	Lens Brake On	High Freq. Gain	High Freq. Gain	Normal Gain	Gain Up	ATSC

Item	Hex	AS=0		AS=1	
		TG2	TG1	TG2	TG1
Tracking Gain Control TG1, TG2=1 GAIN UP	\$10	0	0	0	0
	\$11	0	1	0	1
	\$12	1	0	1	0
	\$13	1	1	1	1
	\$14	0	0	0	0
	\$15	0	1	0	1
	\$16	1	0	1	0
	\$17	1	1	1	1
\$13,\$17,\$1B,\$1F (AS0) \$13,\$17,\$18,\$1C (AS1) TRACKING GAIN UP At this time, MIRROR MUTTING is OFF	\$18	0	0	1	1
	\$19	0	1	1	0
	\$1A	1	0	0	1
	\$1B	1	1	0	0
	\$1C	0	0	1	1
	\$1D	0	1	1	0
	\$1E	1	0	0	1
	\$1F	1	1	0	0

\$2X

D7	D6	D5	D4	D3			D2			D1		D0		ISTAT Output
				Tracking Servo Mode						Sled Servo Mode				
0	0	1	0	Mode	TM7	TM6	TM5	TM4	TM3	TM2	TM1			
TM1				\$20	1	0	1	0	1	1	0			
0	Track. Servo Off			\$21	1	0	1	0	1	0	0			
1	Track. Servo On			\$22	1	0	0	0	1	1	0			
TM2				\$23	1	1	1	0	1	1	0			
0	Sled. Servo Off			\$24	1	0	1	0	1	1	1			
1	Sled. Servo On			\$25	1	0	1	0	1	0	1			
TM4	TM3	Track. Kick		\$26	1	0	0	0	1	1	1			
0	0	FWD. Jump		\$27	1	1	1	0	1	1	1		TZC	
0	0	Jump Off		\$28	1	0	1	0	0	1	0			
0	0	REV. Jump		\$29	1	0	1	0	0	0	0			
TM4	TM3	Sled. Kick		\$2A	1	0	0	0	0	1	0			
0	0	FWD. Kick		\$2B	1	1	1	0	0	1	0			
0	0	Kick Off		\$2C	1	0	1	1	1	1	0			
0	0	REV. Kick		\$2D	1	0	1	1	1	0	0			
TM7 (Jump)				\$2E	1	0	0	1	1	1	0			
1	Lens Brake On			\$2F	1	0	0	1	1	1	0			



Tracking Condition for DIRC (Direct 1 Track Jump)

Item	Hex	DIRC=1	DIRC=0	DIRC=1
		TM[6:1}	TM[6:1}	TM[6:1}
Tracking Mode	\$20	000000	001000	000011
	\$21	000010	001010	000011
	\$22	010000	011000	100001
	\$23	100000	101000	100001
	\$24	000001	000100	000011
	\$25	000011	000110	000011
	\$26	010001	010100	100001
	\$27	100001	100100	100001
	\$28	000100	001000	000011
	\$29	000110	001010	000011
	\$2A	010100	011000	100001
	\$2B	100100	101000	100001
	\$2C	001000	000100	000011
	\$2D	001010	000100	000011
	\$2E	011000	000100	100001
\$2F	101000	100100	100001	

Resistor \$3X

Address	Focus Search		Sled Kick		Flag Detect Reference	
	D11	D10	D9	D8	D7	D6
<b>D15~D12 0011</b>	PS4 Search+2	PS3 Search+1	PS2 Kick+2	PS1 Kick+1	D7 D6 Defect Duty 0 0 0.45ms 0 1 0.54ms 1 0 0.63ms 1 1 0.73ms	
<b>Initial</b>					0	1
Address	AFRC	SPEAK	MODEC	On/Off	TOCD	RFS
	D5	D4	D3	D2	D1	D0
<b>D15~D12 0011</b>	Equalize 3T input Gain 0: 1X 1: 1.5X	Peaking prevent standard freq. 0: 44 kHz 1: 88 kHz	EFM.SLICE 0: ENVEL. 1: NORMAL	Peaking prevent On/Off 0: 44 kHz 1: 88 kHz	TRACKING offset adjust 0: OFF 1: ON	Focus Servo Cprak Muting 0: Off 1: ON
<b>Initial</b>	0	1	1	0	1	0

NOTES:

1. D7,D6: 11>01>10>00 Equalize precision control
2. D3: Envelope EFM-slice or normal EFM-slice select
3. D1: Tracking Servo offset adjust select§
4. \*\*TOCD: Tracking Balance, Gain, Offset \*\*
5. Register reset command (0: Reset,1: Reset Cancel)

**Select (Upper 8 bits out of 16 bits)**

D7	D6	D5	D4	D3	D2	D1	D0	ISTAT
0	0	1	1	Focus Servo Search Level Control		Sled Servo Kick Level Control		SSTOP
				PS4	PS3	PS2	PS1	
				Search +2	Search +1	Kick +2	Kick +1	
DATA MODE (LEVEL)				Search X1	\$30 ~ \$33	Kick X1	\$30,\$34,\$38,\$3C	
				Search X2	\$34 ~ \$37	Kick X2	\$31,\$35,\$39,\$3D	
				Search X3	\$38 ~ \$3B	Kick X3	\$32,\$36,\$3A,\$3E	
				Search X4	\$3C ~ \$3F	Kick X4	\$33,\$37,\$3B,\$3F	
DATA				S.X1, K.X1	S.X2, K.X2	S.X3, K.X3	S.X4, K.X4	
				\$30	\$35	\$3A	\$3F	

**Auto Sequence Mode**

ADDRESS				DATA			
0	1	0	0	D3	D2	D1	D0
Auto-Sequence Cancel				0	0	0	0
Auto-Focus				0	1	1	1
1-Track Jump				1	0	0	0: FWD 1: REV
10-Track Jump				1	0	1	
2N-Track Jump				1	1	0	
M-Track Jump				1	1	1	
Fast Search				0	1	0	

RAM Resistor Set

Item		Data												
Address		D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	
BLIND A, E OVERFLOW. C	\$5XXX	0.18 ms	0.09 ms	0.04 ms	0.02 ms									
BRAKE. B		0.36 ms	0.18 ms	0.09 ms	0.04 ms									
FAST F		23.2 ms	11.6 ms	5.80 ms	2.90 ms					I/V->1: Current Type 58K SHORT T.RST->1: Adjust value RESET				
FAST K						0.72 ms	0.36 ms	0.18 ms	0.09 ms	I/V SEL	T.RST adjust	EFMB C	FJTS	
	INI	1	0	1	0	1	0	0	0	0	0	0	0	
KICK D	\$6XXX	11.6 ms	5.80 ms	2.90 ms	1.45 ms					EFMBC:0-Single Asy compensation 1-Double ASY compensation				
FAST R		23.2 ms	11.6 ms	5.80 ms	2.90 ms					FJTS: 0:Track mutt off Fast Search 1:Track mutt on Fast Search				
PWM DUTY PD						8	4	2	1					
PWM WIDTH PW										5.80 ms	2.90 ms	1.45 ms	0.75 ms	
		INI.	0	1	1	1	1	0	1	0	0	0	1	0
2N TRA N M TRA. M	\$7XXX	4096	2048	1024	512	256	128	64	32	16	8	4	2	
FAST SEARCH T	\$7XXX	1638 4	8192	4096	2048	1024	512	256	128	64	32	16	8	
	INI.	0	0	0	0	0	0	1	1	1	1	1	1	
BRAKE POINT P	\$BXXX	1638 4	8192	4096	2048	1024	512	256	128	64	32	16	8	
	INI.	0	0	0	0	0	0	1	1	1	0	0	0	

NOTES:

1.

Warning

1. Out of the 16 settings, PWM Width (PW) can select only one of 1, 2, 4, or 8 (not a 4-bit mixture)
2. When using a 2N Track or an M Track, more than 512 Tracks is not recommended (potential for error within the algorithm)
3. There can be a 1~2 error in the PWM Duty (PD), so set to fixed value + 2
4. \$5XXXs I/V SEL command (0: pick-up configuration using both voltage and current, 1: current-type only)

**ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	$V_{max}$		5		V
Operating Temperature	$T_{OPR}$	- 20	25	70	°C
Storage Temperature	$T_{STG}$	- 55	25	150	°C
Permissible Loss	$P_d$		150		mW

**ELECTRICAL CHARACTERISTICS**

No	Item	Symbol	Block	Min	Typ	Max	Unit
1	Supply current 6v	ICCHI	Supply current	20	40	60	mA
2	Supply current 5v	ICCTY		15	32	50	mA
3	Supply current 4v	ICCLO		10	25	40	mA
4	RF AMP offset voltage	$V_{rfo}$	RF AMP	-85	0	+85	mV
5	RF AMP Oscillation voltage	$V_{rfosc}$		0	50	100	mV
6	RF AMP voltage gain	$G_{rf}$		16.2	19.2	22.2	dB
7	RF AMP voltage gain 2	$G_{rf2}$		16.2	19.2	22.2	dB
8	RF RHD charac.	RFTHD		-	-	5	%
9	RF AMP maximum output voltage	$V_{rfpp1}$		3.8	-	-	V
10	RF AMP minimum output voltage	$V_{rfpp2}$		-	-	2.0	V
11	1X RF AC charac.	RFAC1		1.00	1.50	2.0	-
12	2X RF AC charac.	RFAC2		0.50	1.25	4.0	-
13	RF AC coupling charac.	RFAC3		0.7	1	1.3	-
14	RF AC coupling charac. 2	RFAC4		0.2	0.5	0.8	-
15	RF IVSEL connection charac. AC	RFSELAC		35	55	75	Kohm
16	RF IVSEL connection charac. BD	RFSELBD		35	55	75	Kohm
17	RF IVSEL connection charac. AC2	RFSELAC2		RF Boost Option	70	110	150
18	RF IVSEL connection charac. BD2	RFSELBD2	70		110	150	Kohm

No	Item	Symbol	Block	Min	Typ	Max	Unit
19	FOCUS ERROR OFFSET voltage	VFEO1	Focus Error AMP	-525	-250	-50	mV
20	FOCUS ERROR AUTO voltage	VFEO2		-35	0	+35	mV
21	ISTAT after FEBIAS adjust	VISTAT1		4.3	-	-	V
22	FOCUS ERROR voltage gain 1	GFEAC		18	21	24	dB
23	FOCUS ERROR voltage gain 2	GFEBD		18	21	24	dB
24	FOCUS ERROR voltage gain difference	Delta GFE		-3	0	+3	dB
25	FOCUS ERROR AC difference	VFEACP		0	50	100	mV
26	FERR maximum output voltage H	VFEPH		4.4	-	-	V
27	FERR minimum output voltage L	VFEPPL		-	-	0.6	V
28	AGC max. gain	GAGC	RF AGC & Equalizer	16	19	22	dB
29	AGC EQ gain	GEQ		0	1	2	dB
30	AGC normal gain	GAGC2		3.0	6	9	dB
31	AGC compress ratio	CAGC		0	2.5	5	dB
32	AGC frequency	FAGC		-1.5	0	2.5	dB
33	AGC level control 1	AGCL1		1.03	1.15	1.3	-
34	AGC level control 2	AGCL2		1.0	1.15	1.3	-
35	AGC level control 3	AGCL3		1.0	1.15	1.25	-

No	Item	Symbol	Block	Min	Typ	Max	Unit
36	TERR gain voltage gain 1	GTEF1	Tracking Error Gain & Balance	-1.5	0.5	2	dB
37	TERR gain voltage gain 2	GTEF2		1	1.7	2.4	-
38	TERR gain voltage gain 3	GTEF3		1	1.3	1.6	-
39	TERR gain voltage gain 4	GTEF4		1	1.45	1.9	-
40	TERR gain voltage gain 5	GTEF5		1	1.55	2.1	-
41	TERR gain voltage gain 6	GTEF6		1	1.45	1.9	-
42	TERR gain voltage gain 7	GTEF7		1	1.45	1.9	-
43	TERR balance gain	GTEE		10.5	13.5	16.5	dB
44	TERR balance mode 1	TBE1		1.0	1.05	1.1	-
45	TERR balance mode 2	TBE2		1.0	1.05	1.1	-
46	TERR balance mode 3	TBE3		1.0	1.05	1.1	-
47	TERR balance mode 4	TBE4		1.0	1.10	1.5	-
48	TERR balance mode 5	TBE5		1.0	1.20	1.4	-
49	TERR balance mode 6	TBE6		1.0	1.3	1.75	-
50	TERR EF voltage gain difference	Delta GTEF		10.0	13.0	16.0	dB
51	TERR maximum output voltage H	VTPPH		3.5	-	-	V
52	TERR minimum output voltage L	VTPPL		-	-	1.5	V
53	APC PSUB voltage L	APSL	Automatic Power Control (APC)	-	-	1.2	V
54	APC PSUB voltage H	APSH		3.8	-	-	V
55	APC NSUB voltage L	ANSL		-	-	1.2	V
56	APC NSUB voltage H	ANSH		3.8	-	-	V
57	APC PSUB voltage LDOFF	APSLOF		4.0	-	-	V
58	APC NSUB voltage LDOFF	ANSLOF		-	-	1.0	V
59	APC current drive H	ACDH		2.5	-	-	V
60	APC current drive L	ACDL		-	-	2.5	V
61	MIRROR minimum operating freq.	FMIRB	MIRROR	-	550	900	HZ
62	MIRROR maximum operating freq.	FMIRP		30	75	-	Khz
63	MIRROR AM charac.	FMIRA		-	400	600	HZ
64	MIRROR minimum input voltage	VMIRL		-	0.1	0.2	V
65	MIRROR maximum input voltage	VMIRH		1.8	-	-	V

No	Item	Symbol	Block	Min	Typ	Max	Unit
66	FOK THRESHOLD voltage	VFOKT	FOK	-420	-350	-300	mV
67	FOK output voltage H	VFOHH		4.3	-	-	V
68	FOK output voltage L	VFOKL		-	-	0.7	V
69	FOK freq. charac.	FFOK		40	45	50	KHZ
70	DEFECT BOTTOM voltage	FDFCTB	DEFECT	-	670	1000	HZ
71	DEFECT Cutoff voltage	FDFCTC		2.0	4.7	-	KHZ
72	DEFECT minimum input voltage	VDFCTL		-	0.3	0.5	V
73	DEFECT maximum input voltage	VDFCTH		1.8	-	-	V
74	NORMAL EFM DUTY voltage 1	NDEFMN	Normal EFM Slice	-50	0	+50	mV
75	NORMAL EFM DUTY symmetry	NDEFMA		0	5	10	%
76	NORMAL EFM DUTY voltage 3	NDEFMH		0	+50	+100	mV
77	NORMAL EFM DUTY voltage 4	NDEFML		-100	-50	0	mV
78	NORMAL EFM minimum input voltage	NDEFMV		-	-	0.12	V
79	NORMAL EFM DUTY difference 1	NDEFM1		30	50	70	mV
80	NORMAL EFM DUTY difference 1	NDEFM2	30	50	70	mV	
81	ENV EFM DUTY voltage 1	EDEFMN1	Envelope EFM Slice	-50	0	+50	mV
82	ENV EFM DUTY voltage 2	EDEFMN2		-50	0	+50	mV
83	ENV EFM DUTY symmetry	EDEFMA		0	5	10	%
84	ENV EFM DUTY voltage 3	EDEFMH1		0	+50	+100	mV
85	ENV EFM DUTY voltage 4	EDEFMH2		+160	+250	+340	mV
86	ENV EFM DUTY voltage 5	EDEFML1		-100	-50	0	mV
87	ENV EFM DUTY voltage 6	EDEFML2		-340	-250	-160	mV
88	ENV EFM minimum input voltage	EDEFMV		-	-	0.12	V
89	FZC THRESHOLD voltage	VFZC		35	69	100	mV
90	ANTI-SHOCK detect H	VATSCH		7	32	67	mV
91	ANTI-SHOCK detect L	VATSCL		-67	-32	-7	mV
92	TZC THRESHOLD voltage	VTZC		-30	0	+30	mV
93	SSTOP THRESHOLD voltage	VSSTOP		-100	-65	-30	mV

No	Item	Symbol	Block	Min	Typ	Max	Unit
94	TRACKING GAIN WIN T1	VTGWT1		200	250	300	mV
95	TRACKING GAIN WIN T2	VTGWT2		100	150	200	mV
96	TRACKING GAIN WIN I1	VTGWI1		250	300	350	mV
97	TRACKING GAIN WIN I2	VTGWI2		150	200	250	mV
98	TRACKING BAL WIN T1	VTGW11		-50	0	+50	mV
99	TRACKING BAL WIN T2	VTGW12		-40	0	+40	mV
100	VREG voltage	VREG	Reference Voltage	3.20	3.45	3.65	V
101	Reference voltage	VREF		-100	0	+100	mV
102	Reference current H	IREFH		-100	0	+100	mV
103	Reference current L	IREFL		-100	0	+100	mV



No	Item	Symbol	Block	Min	Typ	Max	Unit	
104	F.SERVO OFF OFFSET	VOSF1	Focus Servo	-100	0	+100	mV	
105	F.SERVO DAC ON OFFSET	VOSF2		0	+250	+550	mV	
106	F.SERVO AUTO OFFSET	VAOF		-65	0	+65	mV	
107	F.SERVO AUTO ISTAT	VISTAT2		4.3	-	-	V	
108	FERR FEBIAS status	VFEBIAS		-50	0	+50	mV	
109	F.SERVO loop gain	GF		19	21.5	24	dB	
110	F.SERVO output voltage H	VFOH		4.4	-	-	V	
111	F.SERVO output voltage L	VFOL		-	-	0.75	V	
112	F.SERVO maximum output voltage H	VFOMH		3.68	-	-	V	
113	F.SERVO maximum output voltage L	VFOML		-	-	1.32	V	
114	F.SERVO osillation voltage	VFOSC		0	+100	+185	mV	
115	F.SERVO FEED through	GFF		-	-	-35	dB	
116	F.SERVO search voltage H	VFSH		+0.35	+0.50	+0.65	V	
117	F.SERVO voltage L	VFSL		-0.65	-0.50	-0.35	V	
118	FOCUS full gain	GFSFG		40.5	42.5	45.0	dB	
119	F.SERVO AC gain 1	GFA1		19.0	23.0	27.0	dB	
120	F.SERVO AC phase 1	PFA1		30	65	90	deg	
121	F.SERVO AC gain 2	GFA2		14.0	18.5	23.0	dB	
122	F.SERVO AC phase 2	PFA2		30	65	90	deg	
123	F.SERVO mutting	GMUTT		-	-	-15	dB	
124	F.SERVO AC charac. 1	GFAC1		0.75	0.85	0.95	-	
125	F.SERVO AC charac. 2	GFAC2		0.68	0.78	0.88	-	
126	F.SERVO AC charac. 3	GFAC3		0.60	0.70	0.80	-	
127	F.SERVO AC charac. 4	GFAC4		0.68	0.78	0.88	-	
128	F.SERVO AC charac. 5	GFAC5		0.94	1.04	1.14	-	
129	F.SERVO AC charac. 6	GFAC6		0.73	0.83	0.93	-	
130	T.SERVO DC gain	GTO			13.5	15.0	17.75	dB
131	T.SERVO OFF offset	VOST1			-100	0	+100	mV
132	T.SERVO DAC offset	VTDAC			150	320	550	mV
133	T.SERVO ON offset	VOST2		-250	0	+250	mV	
134	T.SERVO AUTO offset	VTAOF		-50	0	+50	mV	
135	T.SERVO oscillation	VTOSC		0	+100	+185	mV	
136	T.SERVO ATSC gain	GATSC		17.5	20.5	23.5	dB	

No	Item	Symbol	Block	Min	Typ	Max	Unit
137	T.SERVO LOCK gain	GLOCK		17.5	20.5	23.5	dB
138	T.SERVO gain up	GTUP		17.5	20.5	23.5	dB
139	T.SERVO output voltage H	VTSH		4.48	-	-	V
140	T.SERVO output voltage L	VTSL		-	-	0.52	V
141	T.SERVO maximum output voltage H	VTSMH		3.68	-	-	V
142	T.SERVO minimum output voltage L	VTSMH		-	-	1.32	V
143	T.SERVO JUMP H	VTJH		0.35	0.5	0.65	V
144	T.SERVO JUMP L	VTJL		-0.65	-0.5	-0.35	V
145	T.SERVO DIRC H	VDIRCH		0.35	0.5	0.65	V
146	T.SERVO DIRC L	VDIRCL		-0.65	-0.5	-0.35	V
147	T.SERVO output voltage L	GTFE		-	-	-39	dB
148	T.SERVO AC gain 1	GTA1		9.0	12.5	16.0	dB
149	T.SERVO AC phase 1	PTA1		-140	-115	-90	deg
150	T.SERVO AC gain 2	GTA2		17.5	21.5	25.5	dB
151	T.SERVO AC phase 2	PTA2		-195	-150	-100	deg
152	T.SERVO full gain	GTFG		29.5	32	34.75	dB
153	T.SERVO AC charac. 1	GTAC1		0.59	0.69	0.90	-
154	T.SERVO AC charac. 2	GTAC2		0.75	0.85	0.95	-
155	T.SERVO AC charac. 3	GTAC3		0.65	0.75	0.85	-
156	T.SERVO AC charac. 4	GTAC4		1.30	1.35	1.50	-
157	T.SERVO AC charac. 5	GTAC5		1.15	1.25	1.35	-
158	T.SERVO AC charac. 6	GTAC6		1.01	1.11	1.21	-
159	T.SERVO LOOP MUTT	TSMUTT		-250	0	+250	mV
160	T.SERVO LOOP MUTT AC	TSMTAC		0	+50	+100	mV
161	T.SERVO INT MUTT M1	TSMTM1		0	+50	+100	mV
162	T.SERVO INT MUTT M2	TSMTM2		0	+50	+100	mV
163	T.SERVO INT MUTT M4	TSMTM4		0	+50	+100	mV
164	SL.SERVO DC gain	GSL		20.5	22.5	24.5	dB
165	SL.SERVO FEED through	GSLF		-	-	-34	dB
166	SL.SERVO lock	SLOCK		0	+50	+100	mV
167	SLED forward kick	VSKH		0.45	0.60	0.75	V
168	SLED reverse kick	VSKL		-0.75	-0.60	-0.45	V
169	SLED output voltage H	VSLH		4.48	-	-	V

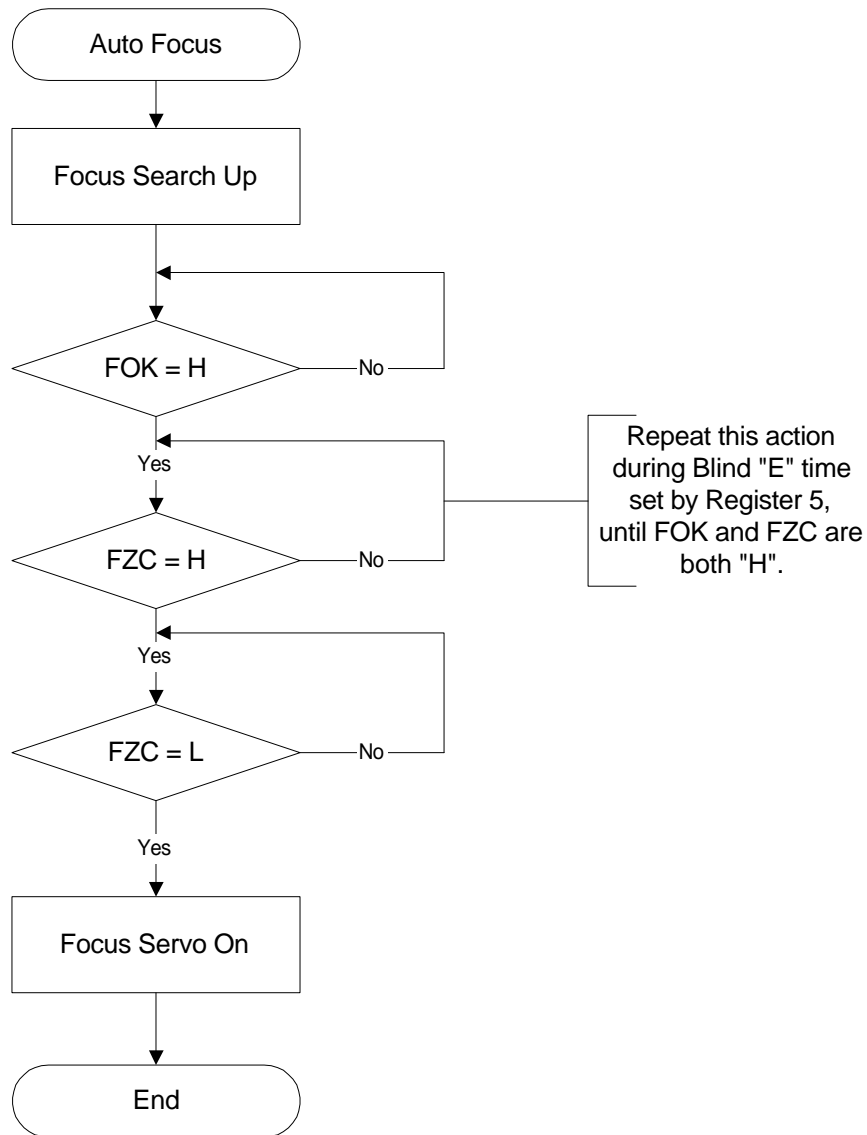
No	Item	Symbol	Block	Min	Typ	Max	Unit
170	SLED output voltage L	VSL L		-	-	0.52	V
171	SLED maximum output voltage H	VSLMH		3.68	-	-	V
172	SLED minimum output voltage L	VSLML		-	-	1.32	V
173	SP.SERVO 1X gain	GSP		14.0	16.5	19.0	dB
174	SP.SERVO 2X gain	GSP2		19.0	23.0	27.0	dB
175	SP.SERVO output voltage H	VSPH		4.48	-	-	V
176	SP.SERVO output voltage L	V SPL		-	-	0.52	V
177	SP.SERVO maximum output voltage H	VSPMH		3.68	-	-	V
178	SP.SERVO minimum output voltage L	VSPML		-	-	1.32	V
179	SP.SERVO AC gain 1	GSPA1		-7.0	-3.5	0	dB
180	SP.SERVO AC phase 1	PSPA1		-120	-90	-60	deg
181	SP.SERVO SMEF gain	GSMEF		13.0	16.5	20.0	dB
182	SP.SERVO AC gain 2	GSPA2		5.5	9.0	12.5	dB
183	SP.SERVO AC phase 2	PSPA2		-120	-90	-60	deg

**AUTO-SEQUENCE**

This feature automatically carries out the following commands: Auto-Focus, Track Jump, and Move. During Auto-Sequence, it Latches the Data when MLT is L, and outputs H when ISTAT is L and at the end.

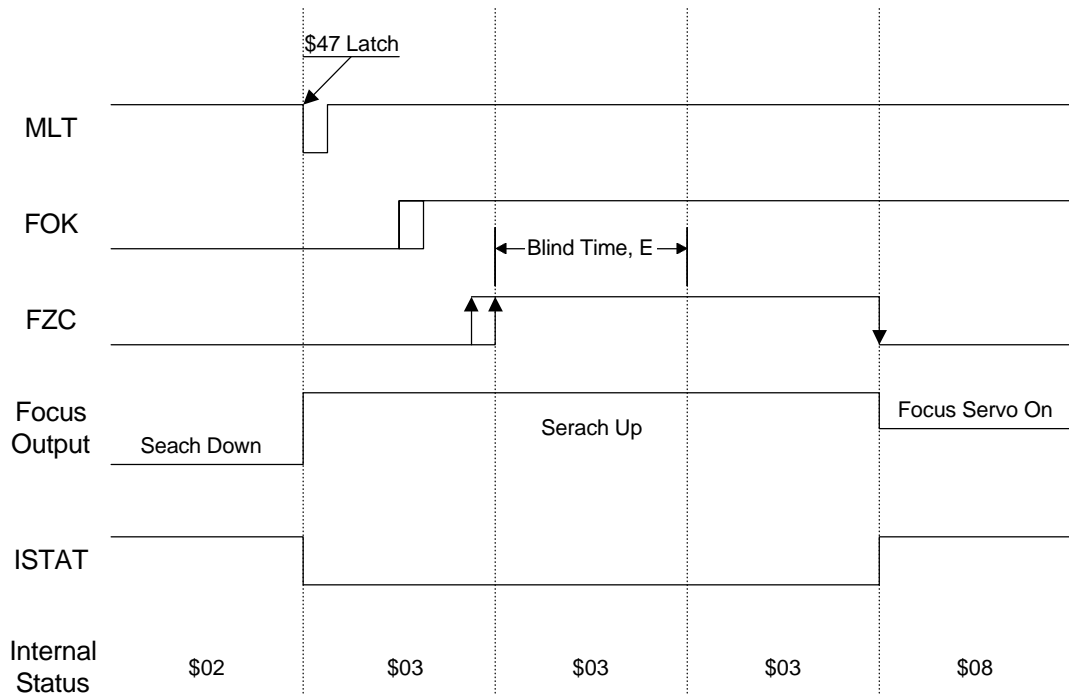
**AUTO FOCUS**

Flow CHart



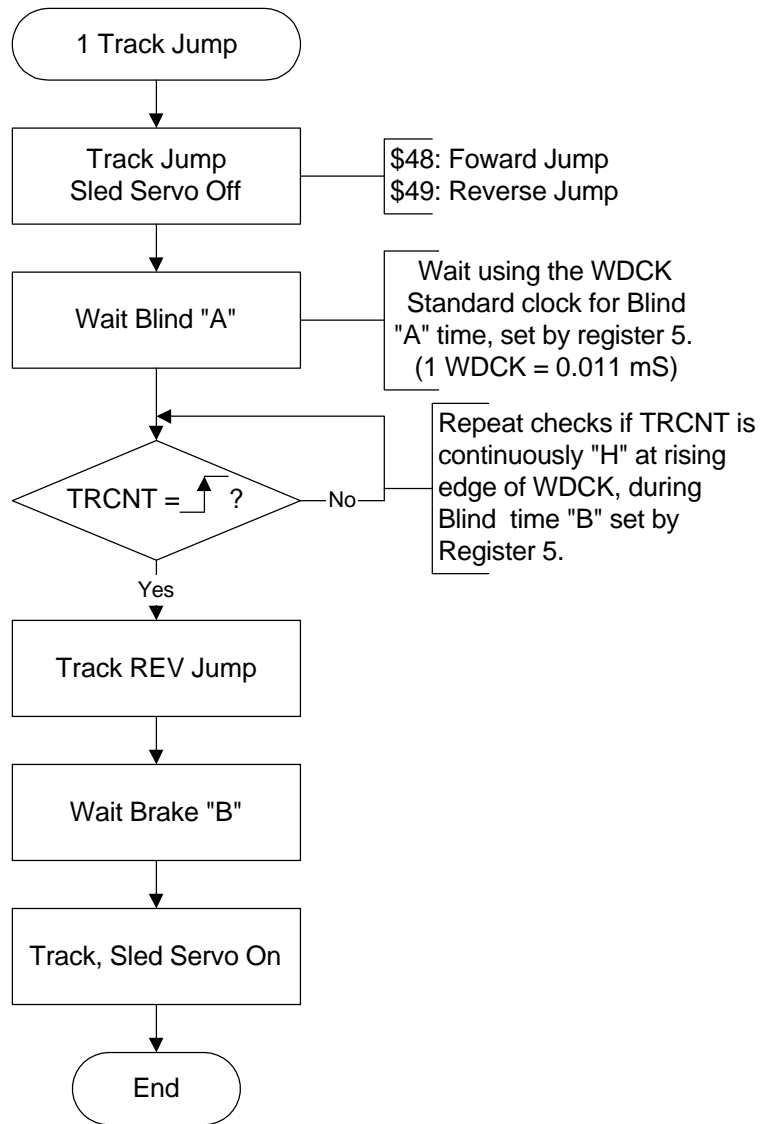
Timing Chart

The AUTO-FOCUS carries out the Focus Search UP by receiving the Auto-Focus command from MICOM in Focus Search DOWN status. SSP is Focus Servo ON when the internal FOK and FZC satisfy the all H time set Blind E (Register \$5X) and transfer FZC to L. Then the internal Auto-Focus is finished, and transmitted to MICOM through the ISTAT output.



1 TRACK JUMP {\$48 (FWD), \$49 (REV)}

FLOW-CHART

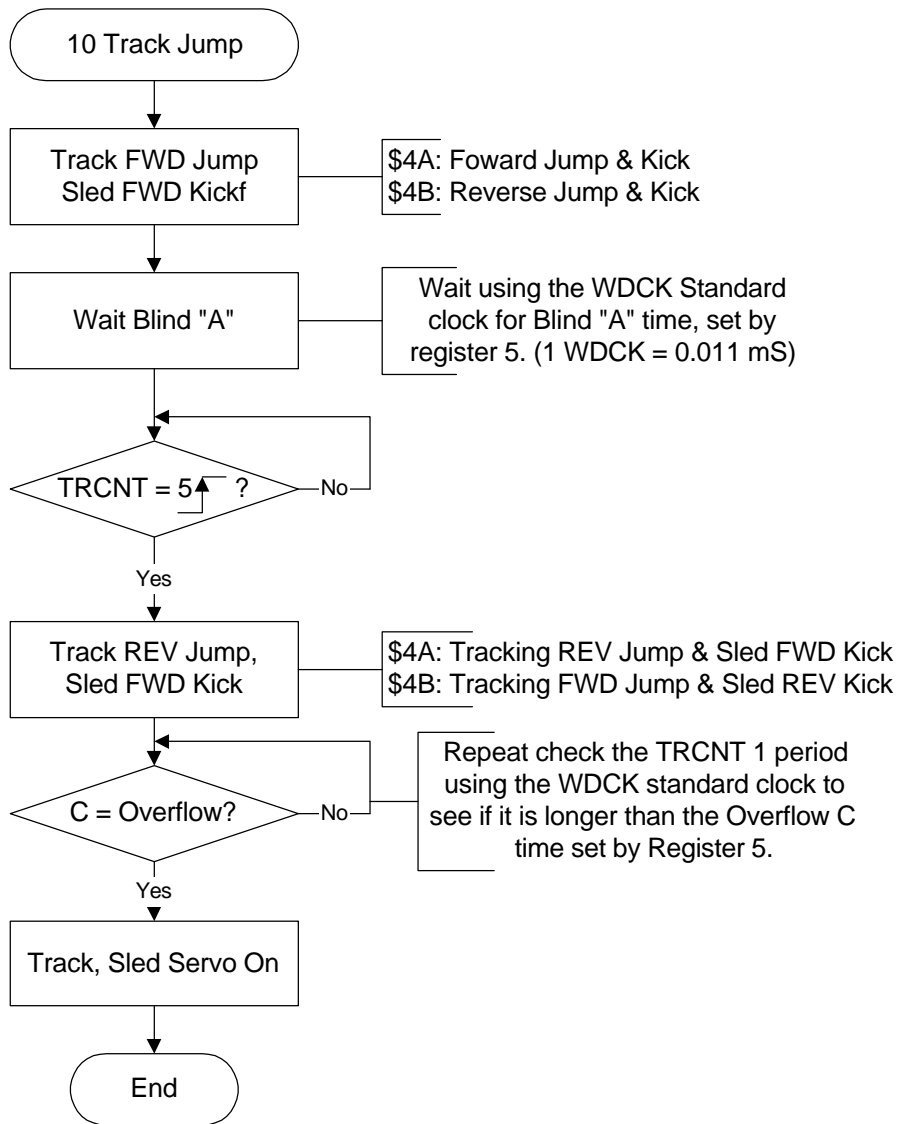


1 Track Jump Timing Chart

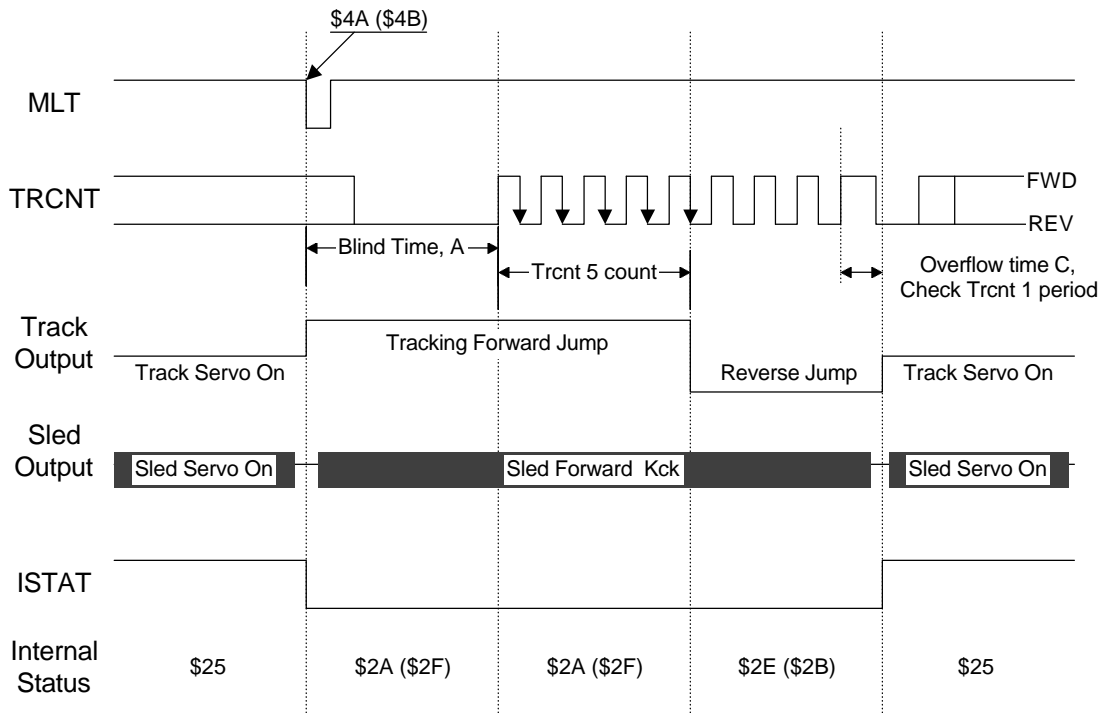
**NOTE:** Inside ( ) means Reverse.

Track Jump is carried out after receiving \$48 (\$49), and the blind time and the brake time is set by Register \$5X.

10 TRACK JUMP {\$4A (FWD), \$4B (REV)}



10 Track Jump Timing Chart {\$4A(FWD), \$4B(REV), inside () is Reverse}

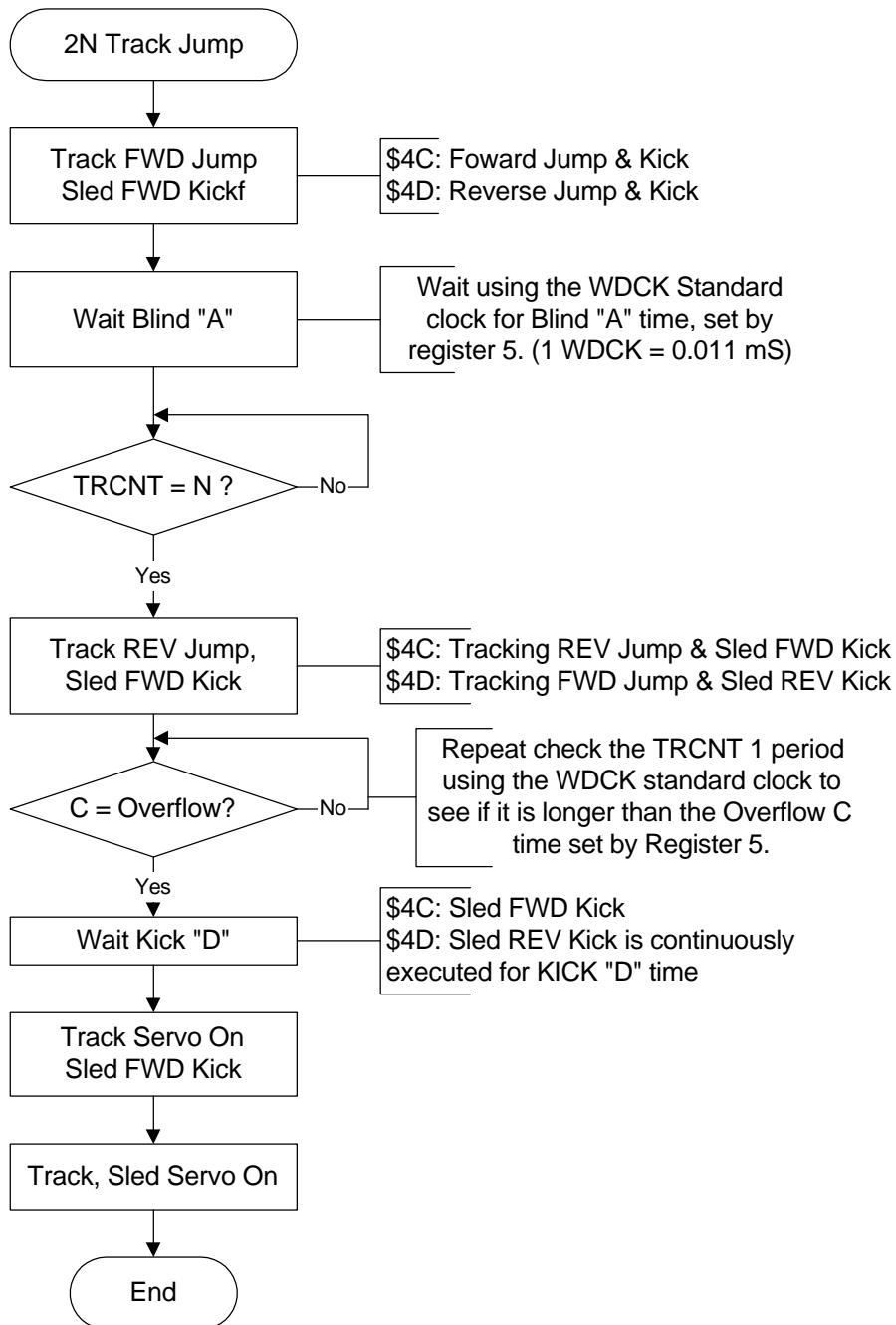


10 Track Jump carries out Tracking Forward Jump until the Trcnt 5 track count. It carries out Tracking reverse Jump until one period of Trcnt is longer than the Overflow C select time, then turns the Tracking Servo and Sled Servo On. This function is to check if the Actuator speed is enough to turn the Servo On.

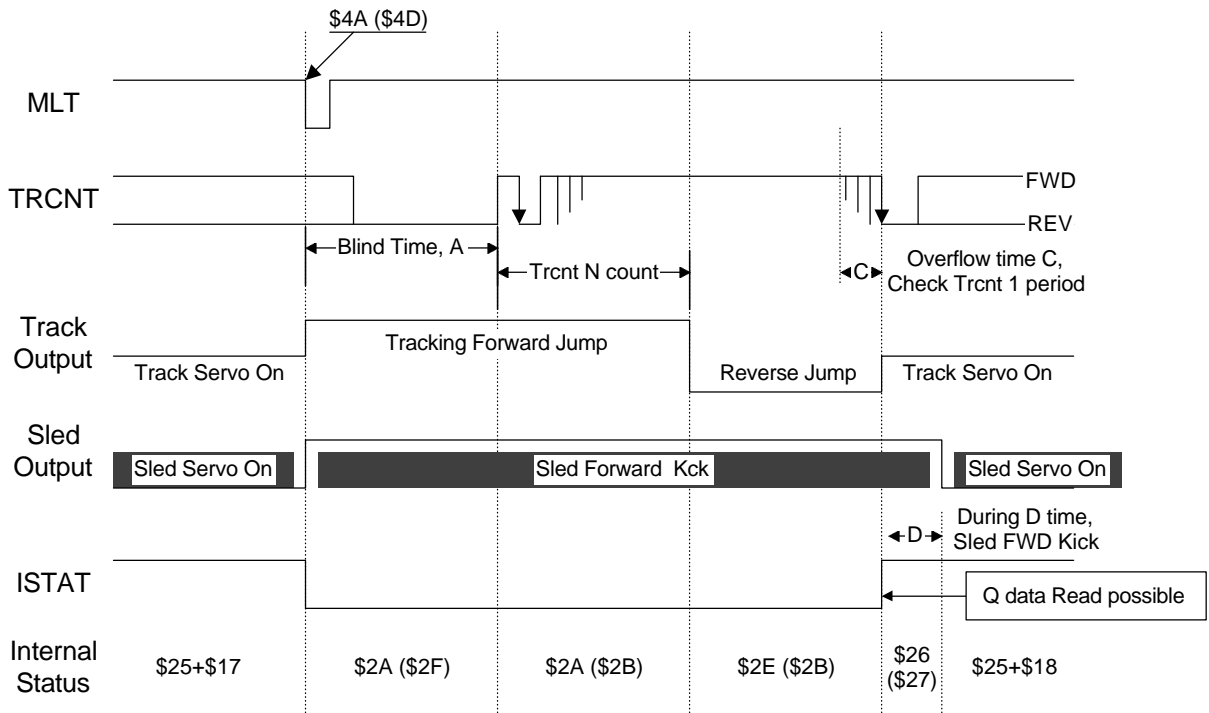


2N TRACK JUMP

Flow-Chart



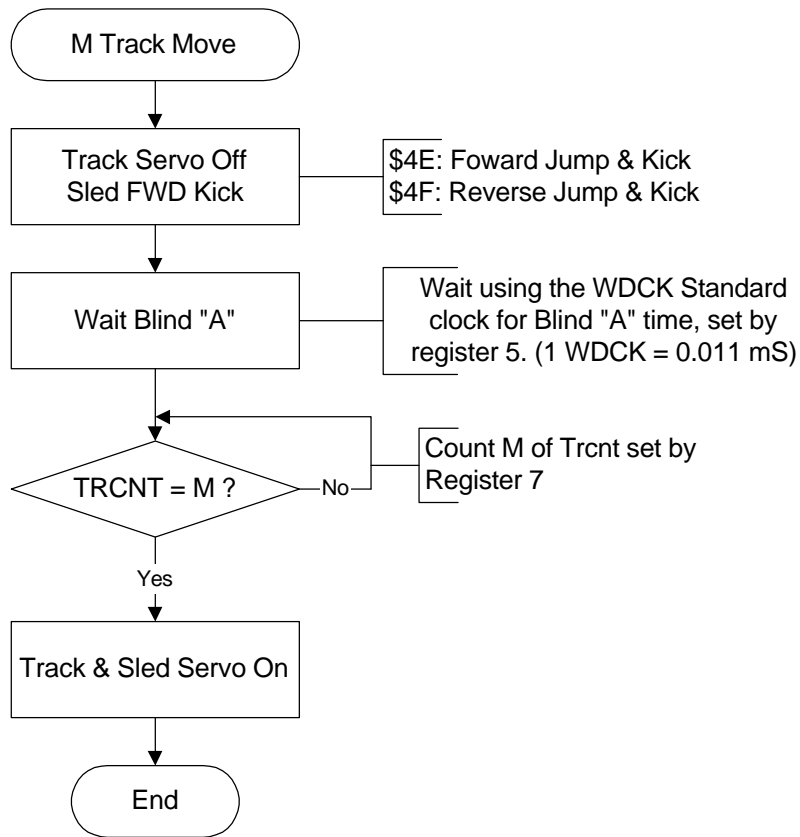
2N Track Jump Timing Chart {\$4C(FWD), \$4D(REV), inside () is Reverse}



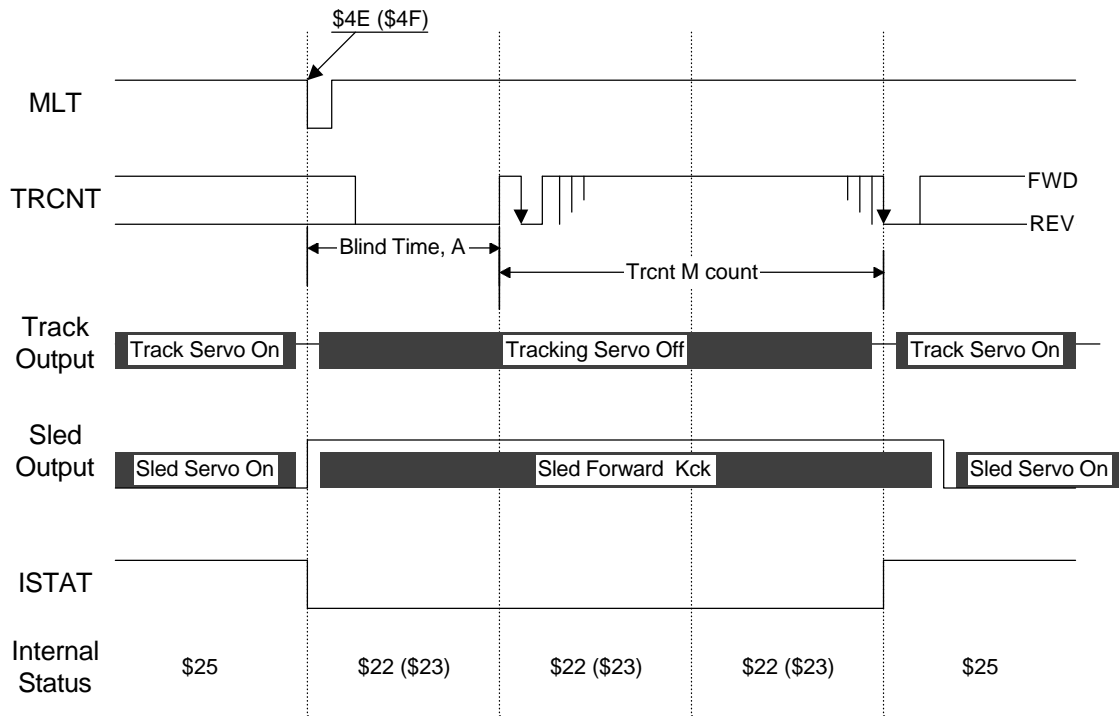
Similar to 10 track. KICK D time is added to the Sled Kick and carried out. Servo is turned On after Lens Brake execution.

M TRACK JUMP {\$4E(FWD), \$4F(REV)}

FLOW-CHART



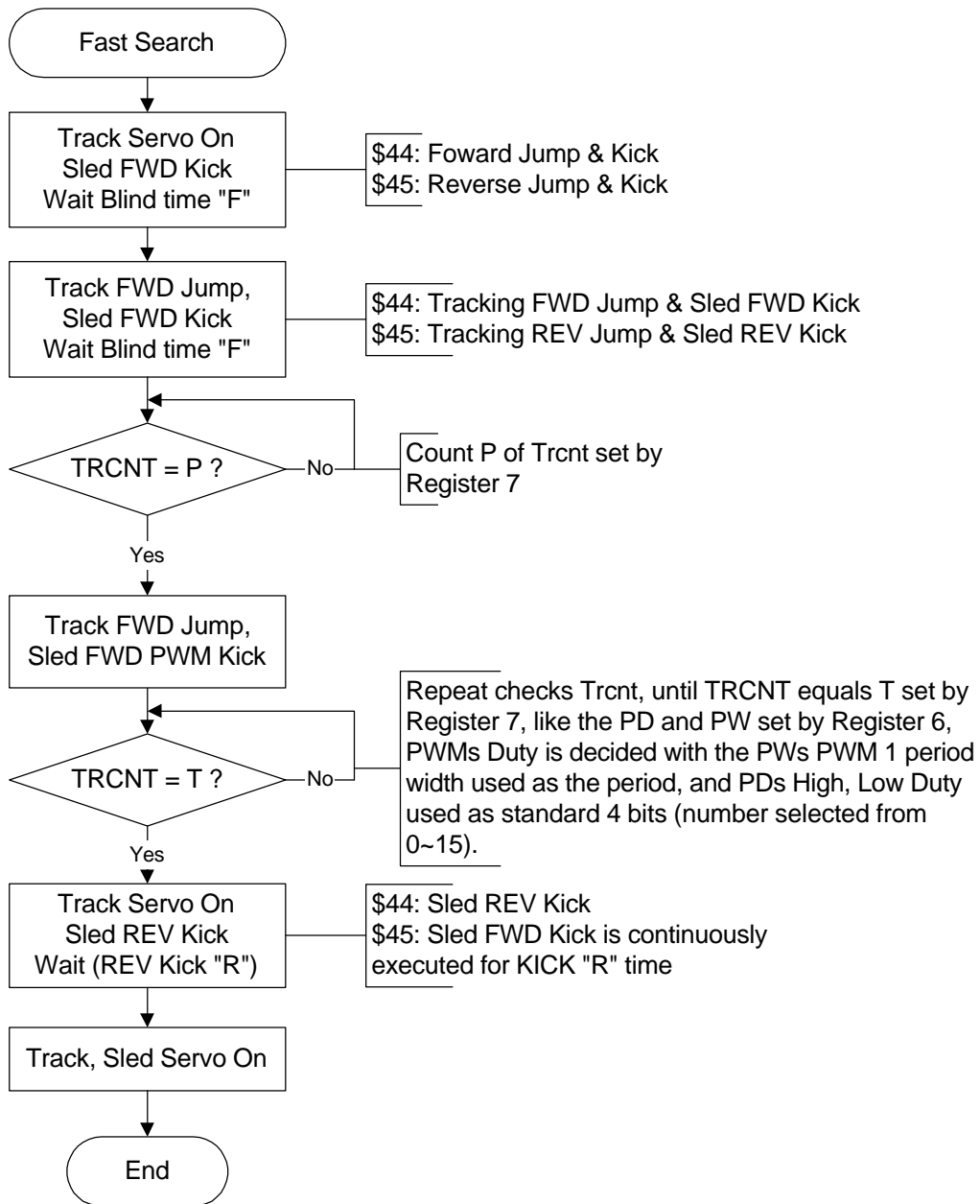
M Track Jump Timing Chart {\$4E(FWD), \$4F(REV), inside () is Reverse}

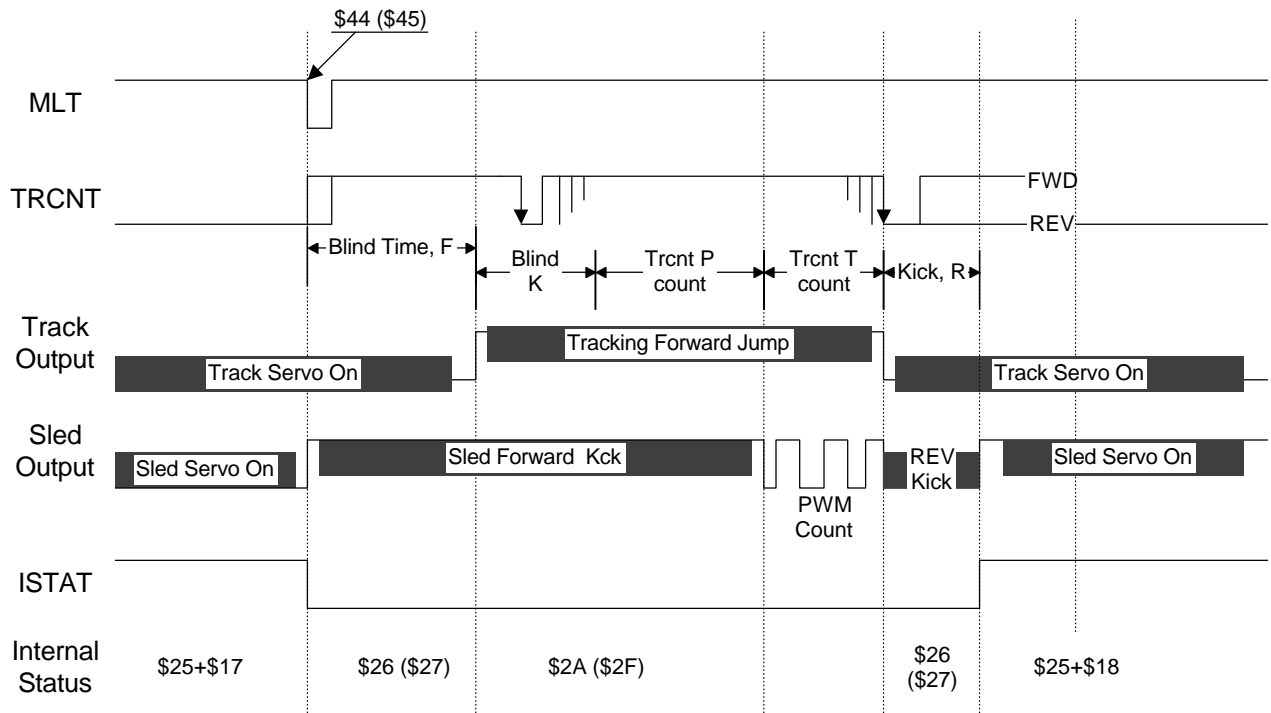


Sled Kick is carried out by counting Trcnt for the set M count value set by Register 7, using the clock.

FAST SEARCH

FLOW-CHART





\*\*\*\* \$5XXX FJTS=1: Tracking Forward Jump Changed Tracking Mutting \*\*\*\*

**Suggestions for using AUTO-SEQUENCE**

- Tracking Gain Up and Brake On (\$17) must be transmitted when carrying out 1, 10, 2n, Track Jump, and Fast Search.
- The entire Auto-sequence modes Mlt becomes L, and the Sequence process is carried out at the initial Wdck Falling Edge after Data Latch.
- Please judge Play status not by Istat, but by Fok and Gfs.
- Tracking Gain Up, Brake, Anti-shock and Focus Gain Down are not carried out in Auto-sequence, and needs a separate command.
- If the Auto-sequence does not operate as Istat Max Time Over, apply \$40 and clear the Ssps internal status, then try again.
- The WDCK mentioned above is input from DSP as 88.2 kHz (2x --> 176 kHz).
- The Auto-sequence internal count differs a little from the actual count.
- 2N and M Track have the potential for errors within the Algorithm, when jumping more than 512 Tracks, so please try to limit use for Track Jumps within 512.
- Please limit the use of the Fast-Search Algorithm for more than 512 Tracks.

## AUTOMATIC ADJUST COMMAND

## Tracking Balance, Gain Adjust

ADDRESS	ADDRESS			DATA						ISTAT	TRCNT
	D11	D10	D9	D8	D7	D6	D5	D4	D3		
Tracking Balance \$80XX~\$81XX	0	0	0	B5	B4	B3	B2	B1	B0	BAL	TRCNT
Initial Value				0	1	1	1	1	1		
Tracking Gain \$81X~\$83X	0	0	0	D4 G4	D3 G3	D2 G2	D1 G1	D0 G0		TGH	TGL
Initial Value				1	0	0	0	0			

## Tracking Balance, Gain Adjust Window

Address	Data				ISTAT	TRCNT
	D3	D2	D1	D0		
\$84X	Tracking Gain Adjust Window TRCNT:ISTAT 0-250MV:200MV 1-150MV:300MV	Tracking Balance Adjust Window 0:-10MV~15MV 1:-20MV~20MV	Focus. Servo Offset Adjust 0:OFF, 1:ON	Fe.bias Offset Adjust 0:OFF,1:ON	\$841 (F.ERR) \$842 (F.SER)	TRCNT
Initial Value	0	0	0	0		

## APC (Automatic Power Control)

Address	Data					ISTAT	TRCNT
	D7 LDON	D6 PNSEL	D5 INTC2	D4 INTC	TRACKING S. WINDOW MUTT		
\$85XX	APC ON/OFF 0: APC ON 1: APC OFF	APC P/N SEL 0:PSUB 1:NSUB	0 0 1 1	0 1 0 1	11 kHz ~ 0.7 kHz Cpeak Mutting 2.75 kHz ~ 0.7 kHz 5.5 kHz ~ 0.7 kHz		
Initial Value	1	0	0	0	0		
Address	D3	D2	D1	D0			
\$85XX	FlagSel	FlagCon	FlagInv	Clock			
	0:Hard Control	0:L falg-SW On	0:FlagB-SW On	0:Lock=1			
	1:Micom Data	1:H falg-SW Off	1:Flag-SW Off	1:Lock=0,1 by DSP			
Initial Value	0	1	1	1			

Register Set 1

Address	Data							
	D7	D6	D5	D4	D3	D2	D1	D0
\$86XX	Focus Servo Offset Value Reset 0:Reset 1:Set	Trcnt Output Type Select (Monitor=1) 0:Fok 1:Trcnt	Trcnt, Monitor Select 1:Fok,TGL TRCNT 0:TEST	Febias Focus S. Offset Clock 0:46ms 1:5.8ms	Flag Hold Time 92.8ms	Flag Hold Time 46.4ms	Flag Hold Time 23.2ms	Flag Hold Time 11.6ms
INITIAL. Value	1	1	1	1	0	1	0	1
	TRCNT select is chosen by the MONITOR(D6), TGL is output when Tracking Gain adjust command (\$82X~\$83X) is given. Others when FOKSEL is '0', FOK is output to the TRCNT pin, when "1" TRCNT is output.							

Register Set 2

Address	Data								
	D7 DIRC	D6 DIRCI	D5 AGCL1	D4 AGCL2	D3 ATSCF	D2 MT0	D1 MT1	D0 MT2	-
\$87XX	DIRC Setting 0:DIRC ON 1:DIRC OFF	Febias Offset Value 0:Reset 1:Set	AGC Level Setting 0 0 1.6V 0 1 1.45V 1 0 1.25V 1 1 1.0V		Envelope EFM Slice mode controled by Lock 0:Off 1:ON	0	0	0	Cpeak
						0	0	1	Fscmpo
						0	1	0	BALH
						0	1	1	Flag
						1	0	0	Dfcint
						1	0	1	Fecmpo
						1	1	0	BALL
						1	1	1	LOCKG
Initial Value	1	1	1	1	0	1	1	1	



Register Set 3

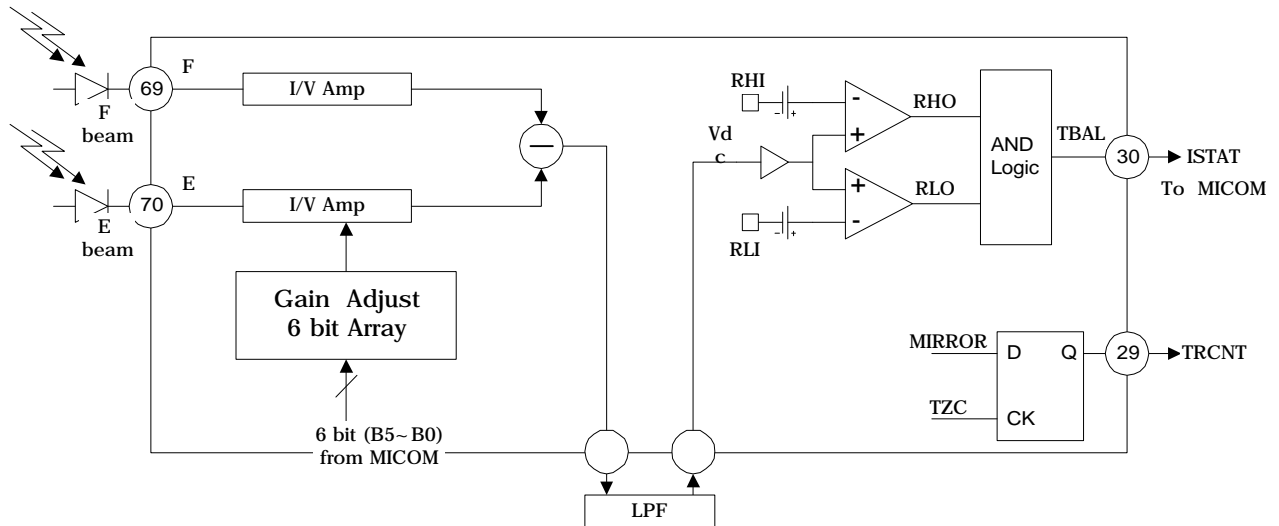
Address	Data								
	D7 EC8	D6 EC7	D5 EC6	D4 EC5	D3 EC4	D2 EC3	D1 EC2	D0 EC1	-
\$8EXX	Tracking Servo Center Peak Freq.		Track Servo Phase Shift	Track Servo Gain Shift	Focus Servo Center Peak Freq.		Focus Servo Gain Shift	Focus Servo Phase Shift	
	0 0	1.2K			0 0	1.2K			
	1 0	1.3K	0:Off	0:Off	1 0	1.3K	0:Off	0:Off	
	0 1	1.4K	1:On	1:On	0 1	1.4K	1:On	1:On	
	1 1	1.5K			1 1	1.5K			
Initial Value	0	0	0	0	0	0	0	0	

Register Set 4

Address	Data									
	D7 TEST	D6 EC10	D5 EC9	D4 TOA4	D3 TOA3	D2 TOA2	D1 TOA1	D0 TOA0	-	
\$8FXX	FOK Defect Mirror Output On/Off	EFM ASY Gain	Envelope EFM Slice Gain	Tracking Servo Loop Offset Control \$8F1F(-160mV ) - > \$8F00(+160mV)						
	0: On 1: Off	0: 1X 1: 2X	0: 2X 1: 1.5X	Monitor Window is same to Tracking Balance Window						
Initial Value	0	0	0	1	0	0	0	0		

**TRACKING BALANCE ADJUST CONCEPT**

The Tracking Balance Adjust automatically adjusts using the following process: The Tracking error DC offset extracted from the pre-set DC voltage window level, and the external LPF are comparison monitored by MICOM.



**Process Summary**

Tracking balance adjust is accomplished in the following manner: With the focus On and spindle servo On, the tracking and sled servo loop is turned off to make the tracking loop into an open loop. The error signal which has passed through the wide-range pick-up and the tracking error amp, passes through the external LPF to extract the DC offset. The DC offset is compared with the pre-selected window comparator level to extract the tracking error amps DC offset within the window, to inform MICOM using the ISTAT that the balance adjust is complete.

At this time, Tracking E beam-side I/V amps gain is selected by MICOM, and the 6-bit resistance arrays resistance value is selected by the 6-bit control signal.

The values that MICOM applies are 000000XXX-->111111XXX. If you select the switch, TE1s DC offset increases the (2.5 V-delta V) --> (2.5 V + delta V) one step at a time, to enter the pre-selected DC window level. When it enters that level, the balance adjust is completed, and the switch condition is latched at this time.

In this adjust process, the TE1 signals frequency distribution is from DC to 2 kHz, so if DC components are included, the DC offset which passed LPF are not accurate DC values. Therefore, if the frequency of the TE1 signal is above 1 kHz, MICOM monitors the window comparator output. The frequency check at this time monitors the Trcnt Pin. Balance Adjust completes the adjustment when the TBAL output is H.

	Vdc < RLI < RHI	RLI < Vdc < RHI	RLI < RHI < Vdc
<b>RHO</b>	H	H	L
<b>RLO</b>	L	H	H
<b>TBAL (AND gate)</b>	L	H	L

RHI: High level threshold value

RLI: Low level threshold value

Vdc: Window comparator input voltage

TBAL: Window comparator outputs AND gate output value

### Tracking Balance Adjust Example

Out of \$8000-→\$81FFs 64steps, the 22 steps excepting the upper and lower 5 steps, are used (\$8040~\$81AF). The limit adjust flow applies the gain to \$8300 at the Focus, Tracking ON point, and checks the TRCNTs frequency. Check if 7 TRCNT came in during 10 ms, and if the answer is YES, check ISTAT, and if NO, repeat the TRCNT number check 3 times, then go to ISTAT Check.

If the 3x repeat fails as well, increase the balance switch one step.

Also, just in case ISTAT does not immediately go to H when ISTAT Checking, wait 10 ms. Check if it is H after the 3x repeat, and if not, increase the balance switch one step. Adjust the wait mentioned above 10 ms, when the system is running.

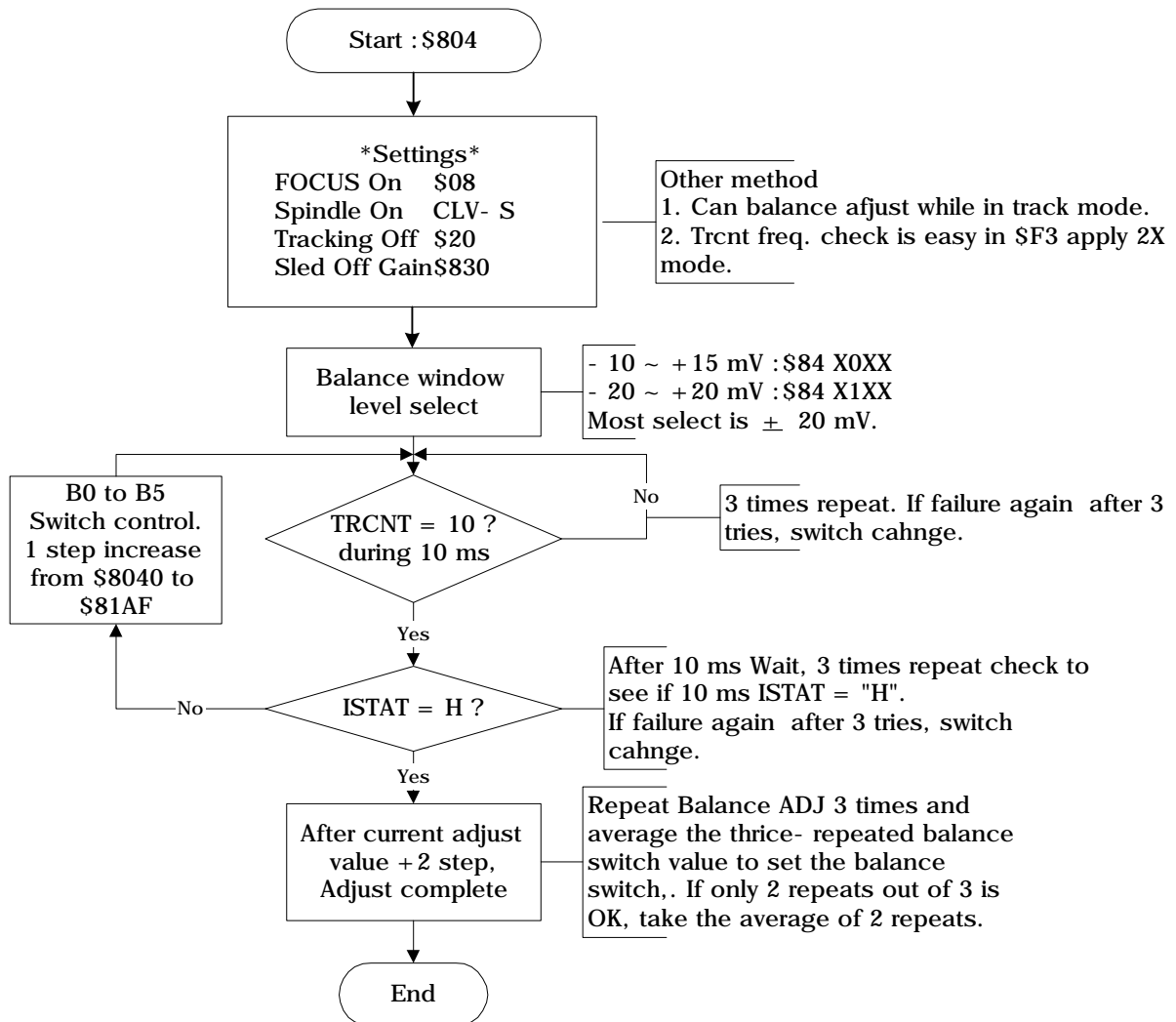
Average the values found by repeating the balance adjust three times.

If only two out of the three tries were successful in getting a balance value, average the two values.

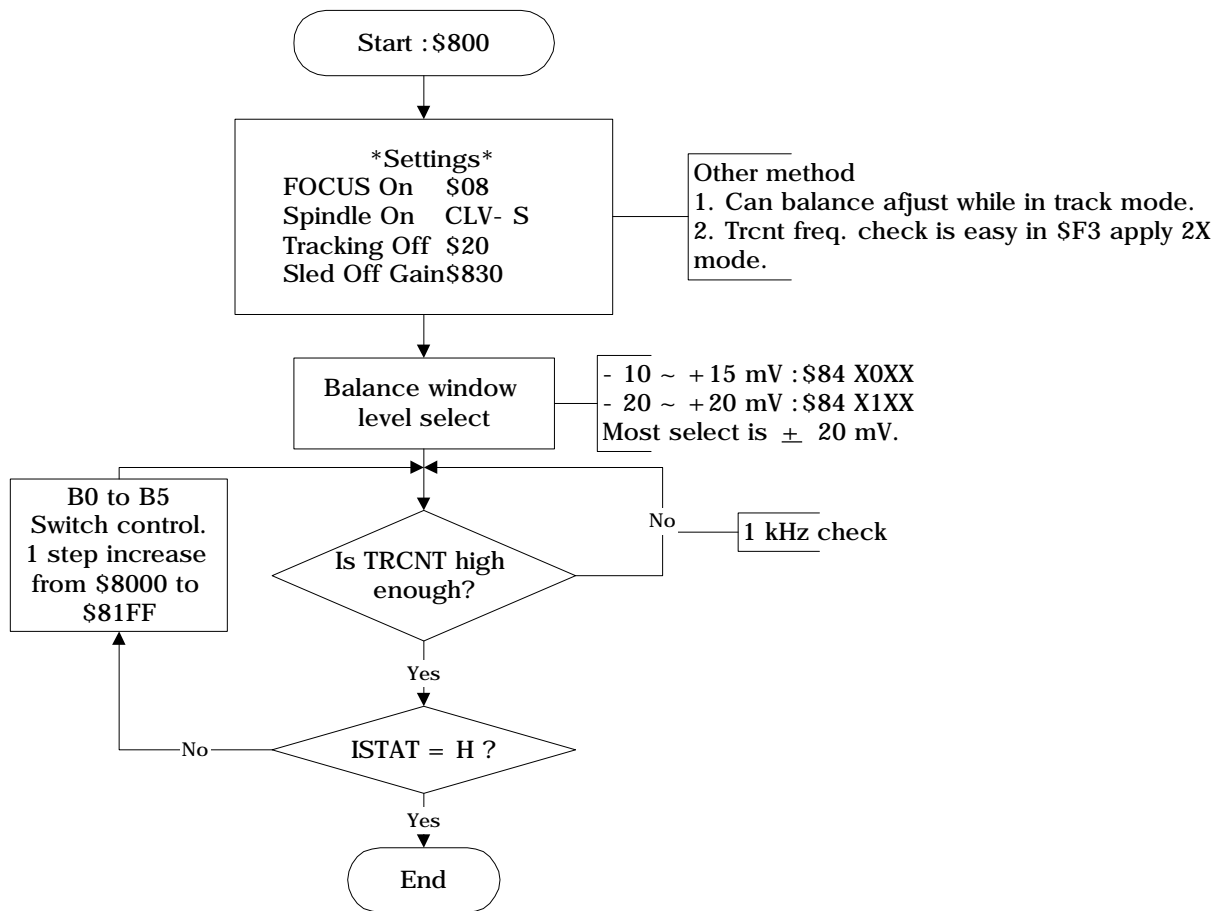
Set as balance switch, this average value, +2. This is because the balance for the system and the minus value for the DC is stable in the system.

Precision is important in balance adjust, and about 1~2 sec is spent as adjust time, which is accounted for.

Balance Adjust Flowchart 1



Balance Adjust Flowchart 2



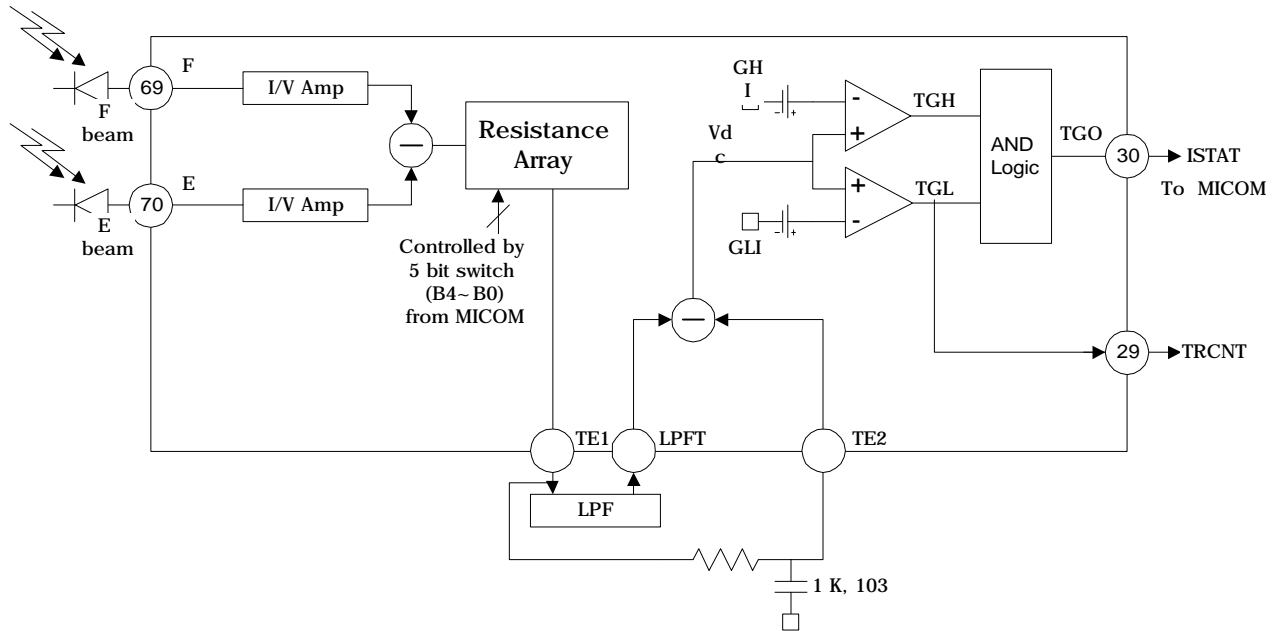
**When Executing Tracking Balance Adjust**

- The Balance adjust is from \$8000 to \$81FF, and the Switch Mode is changed one STEP at a time by 16-bit Data transmission. After Adjust is completed, a separate Latch Pulse is not necessary.
- If the Trcnt Freq. is not high enough, the Balance can be adjusted at \$F3 applied 2x Mode.
- Here, we have suggested Tracking Off status for the Balance Adjust, but the same amount of Flow can be Balance adjusted while in Track Move.
- The Tracking Balance window Select level can be selected by D2 bit out of 12-bit Data. 0: -10 mv ~ +15 mv, 1: -20 mv ~ +20 mv.
- When the Tracking Balance Adjust is complete, start the Tracking Gain Adjust.

Tracking Balance Equivalent Resistor

DATA	TRACKING BALANCE		Fixed R and Parallel R value(440K->0)		6Bit Resister matrix						NOTE			
	TE1 offset	F Resi Equa.	E Resi. Equa.	75K// 6bit R	6bit $\mu\hat{i}^{\circ}j$	13K	27K	56K	110 K	220 K		440 K		
S800	+	391K	531K	6. 29K	6. 87K	1	1	1	1	1	0, 1	<p>F Equav. R</p>		
S801		391K	523. 6K	6. 47K	7. 09K	1	1	1	1	0	0, 1			
S802		391K	515K	6. 68K	7. 33K	1	1	1	0	1	0, 1			
S803		391K	507. 5K	6. 89K	7. 58K	1	1	1	0	0	0, 1			
S804		391K	500. 5K	7. 09K	7. 84K	1	1	0	1	1	0, 1			
S805		↓	391K	492. 5K	7. 33K	8. 12K	1	1	0	1	0	0, 1	<p>E Equav. R</p>	
S806			391K	484. 8K	7. 58K	8. 44K	1	1	0	0	1	0, 1		
S807			391K	477. 1K	7. 85K	8. 77K	1	1	0	0	0	0, 1		
S808			391K	467. 5K	8. 21K	9. 22K	1	0	1	1	1	0, 1		
S809			391K	459. 7K	8. 52K	9. 62K	1	0	1	1	0	0, 1		
S80A			391K	451K	8. 88K	10. 1K	1	0	1	0	1	0, 1		1) 220K//110K=73. 33K
S80B			391K	444. 8K	9. 21K	10. 5K	1	0	1	0	0	0, 1		2) 56K//27K=18. 21K
S80C			391K	437K	9. 62K	11. 0K	1	0	0	1	1	0, 1		3) 27K//13K=8. 775K
S80D			391K	429. 4K	10. 0K	11. 6K	1	0	0	1	0	0, 1		4) 110K//56K=37. 10K
S80E			391K	422K	10. 5K	12. 2K	1	0	0	0	1	0, 1		5) (1)//(2)=14. 58K
S80F			391K	413. 5K	11. 0K	13K	1	0	0	0	0	0, 1		6) (3)//(4)=7. 09K
S810			391K	398. 4K	12. 2K	14. 6K	0	1	1	1	1	0, 1		7) 56K//13K=10. 55K
S811			391K	391. 6K	12. 9K	15. 6K	0	1	1	1	0	0, 1		8) (1)//(7)=9. 223K
S812			391K	383. 8K	13. 7K	16. 8K	0	1	1	0	1	0, 1		9) 56K//220K=44. 63K
S813			391K	376K	14. 6K	18. 2K	0	1	1	0	0	0, 1		A) 56//110/220=31. 74K
S814	391K	368. 6K	15. 6K	19. 7K	0	1	0	1	1	0, 1	B) 13//56//110=9. 62K			
S815	391K	360. 8K	16. 8K	21. 6K	0	1	0	1	0	0, 1	C) (1)//27K=19. 73K			
S816	391K	353K	18. 2K	24K	0	1	0	0	1	0, 1	D) 27K//110K=21. 67K			
S817	391K	345K	19. 8K	27K	0	1	0	0	0	0, 1	E) 27K//220K=24. 04K			
S818	391K	336K	22. 3K	31. 7K	0	0	1	1	1	0, 1				
S819	391K	327. 9K	24. 8K	37. 1K	0	0	1	1	0	0, 1				
S81A	391K	320K	27. 9K	44. 6K	0	0	1	0	1	0, 1				
S81B	391K	312K	32. 1K	56K	0	0	1	0	0	0, 1				
S81C	391K	305K	37K	73. 3K	0	0	0	1	1	0, 1				
S81D	391K	297K	44. 6K	110K	0	0	0	1	0	0, 1				
S81E	391K	289K	55. 9K	220K	0	0	0	0	1	0, 1				
S81F	391K	282K	75K	0K	0	0	0	0	0	0, 1				

**GAIN ADJUSTMENT**



**Process Summary**

The Signal TE1 output by the Tracking Error Amp outputs resistance divide (DC+AC) passes through LPF and the DC Offset extract signal (DC) difference AMP. Only pure AC components are compared with the pre-selected Window Comparators Gain select value to carry out the Tracking Gain Adjustment.

The Resistance Divide changes the 5-bit resistance combination with the MICOM Command, to change the Gain. Tracking Gain Adjustment is carried out in the same conditions as Balance Adjustment, which is: Focus Loop On, Spindle Servo On, Tracking Servo Off and Sled Servo Off. It adjusts the Tracking Error Amps Gain and the wide-range Pick-ups amount of reflection.

The external LPFs Cut-off Frequency is set to 10 Hz ~ 100 Hz.

The Window Comparators comparison level can be chosen from +150 mv ~ +300 mv, and +250 mv ~ +200 mv by MICOM command.

TGL outputs +150 MV and +250 MV comparator output to TRCNT.

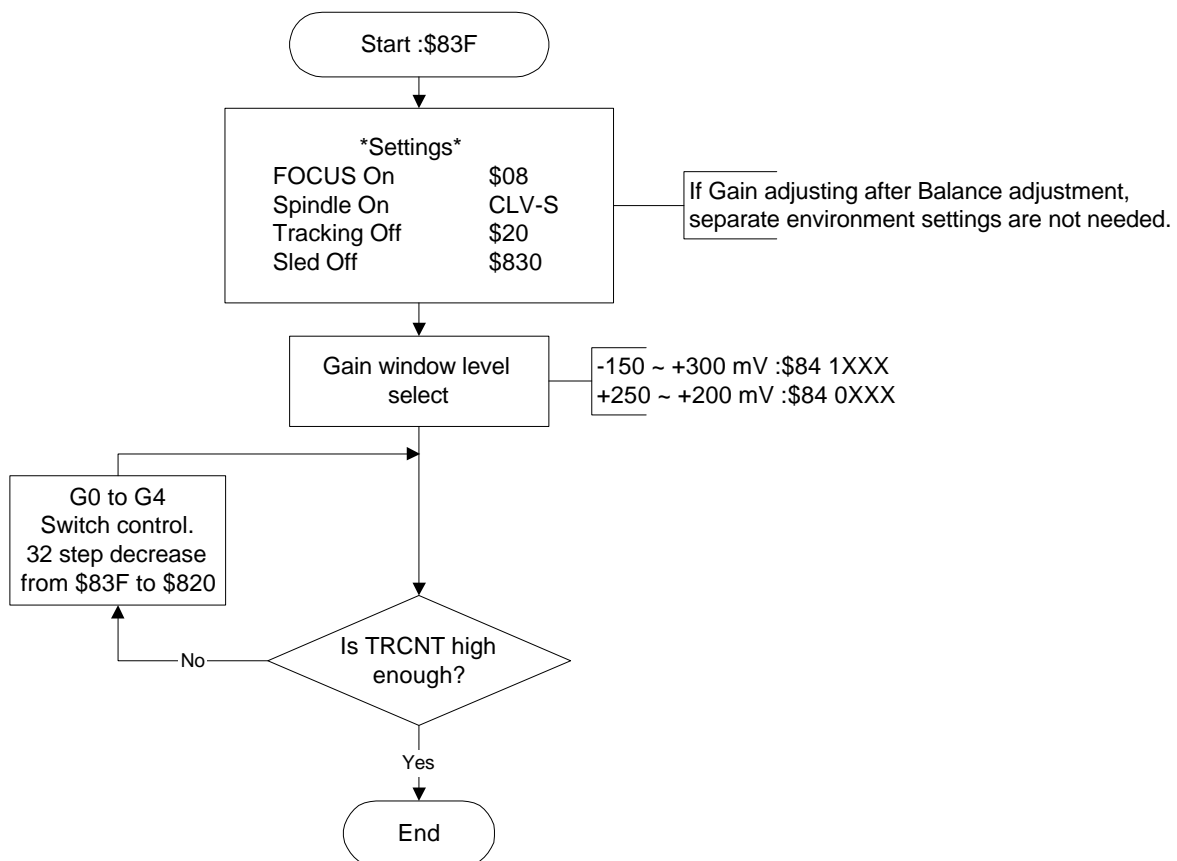
TGH outputs +300 MV and +200 MV comparator output to ISTAT.

	$V_{ac} < G_{LI} < G_{HI}$	$G_{LI} < V_{ac} < G_{HI}$	$G_{LI} < G_{HI} < V_{ac}$
<b>TGH</b>	H	H	L
<b>TGL</b>	L	H	H

Gain Adjustment is complete when the output is H.

**When Adjusting the Tracking Gain**

- In Gain Adjustment, the Switch Mode is changed one Step at a time from \$83F --> \$820 by 12-bit DATA transmission. A separate Latch Pulse is not needed after Adjust completion.
- Trcnt and TGL outputs H Duty Check standard is above 0.1 ms.
- Adjustment is carried out by choosing the most appropriate out of the 4 adjustment modes, including the ones listed above.
- The Tracking Balance Window select level can be selected by the D3 bit out of the 12-bit DATA.  
 0: +250 mv (TGL) ~ +200 mv (TGH)  
 1: +150 mv (TGL) ~ +300 mv (TGH)
- When Tracking Gain Adjustment is complete, Tracking & Sled Servo Loop On and TOC Read is initiated.



Gain Adjust proceeds from Status 1 -->2 -->3 when the MICOM Command carries out Down Command from \$83F --> \$820, in order. Adjustment is complete when in Status 2.

**Gain Adjustment Method 1**

MICOM monitors Trcnts TGL output, and if the outputs H Duty (0.1 ms) is detected, the adjustment is complete. At this time, the Window Comparator Level is +150 mv ~ +300 mv.



Gain Adjustment Method 2

MICOM monitors ISTATs TGO output, and if the outputs H Duty (0.1 ms) is detected, the adjustment is complete. At this time, the Window Comparator Level is +150 mv ~ +300 mv.

Gain Adjustment Method 3

MICOM monitors Trcnts TGL output, and if the outputs H duty (0.1 ms) is detected, the Window Comparator Level is changed from +150 mv ~ +300 mv to +250 mv ~ +200 mv. And when MICOM again monitors Trcnts TGL output and the outputs H duty (0.1 ms) is detected, the adjustment is complete. If you latch the former MICOM Command value and the latter MICOM Command values median, it is possible to Gain adjust +200 mv.

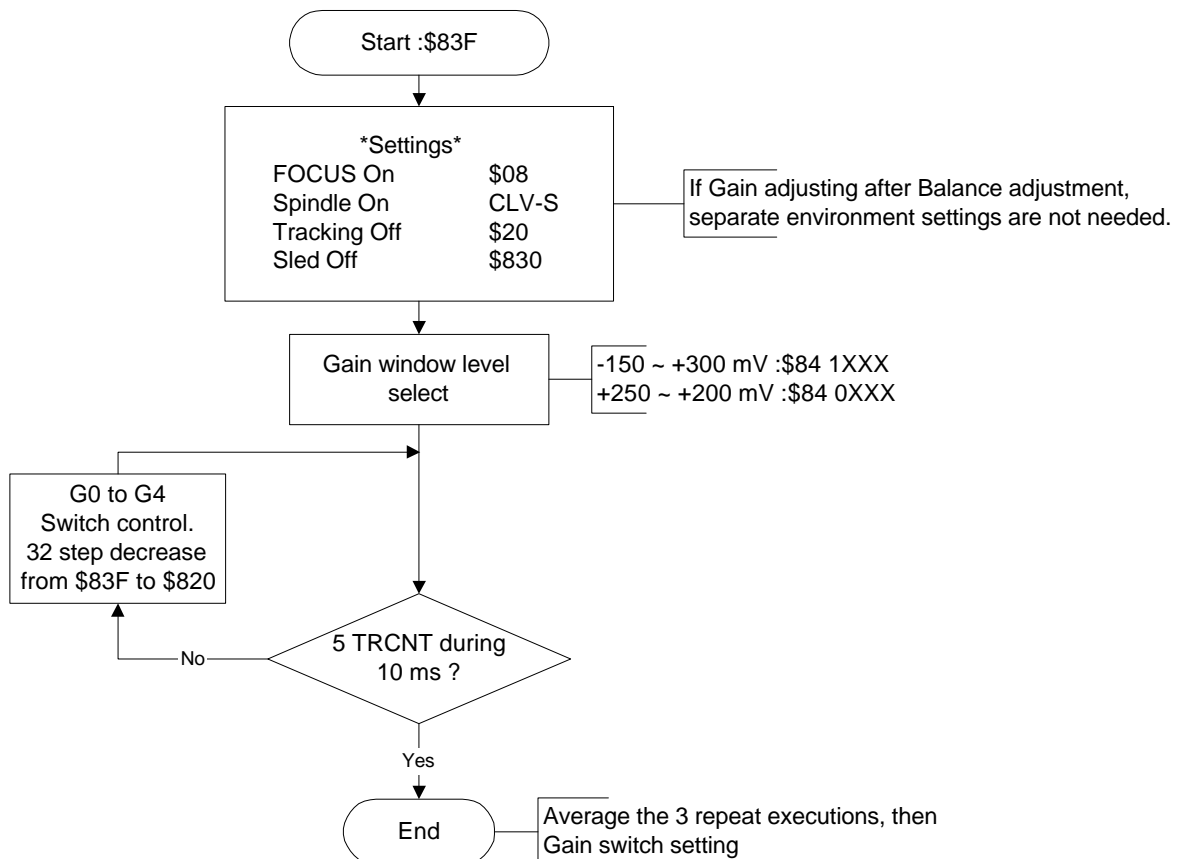
Gain Adjustment Method 4

MICOM monitors Trcnts TGL output, and if the outputs H Duty (0.1 ms) is detected, MICOM Command goes 1 Step Down, and adjustment is completed. At this time, the Window Comparator Level is +150 mv ~ +300 mv.

Gain Adjustment Method 5

Gain Adjustment is set to a total of 32 steps, and Gain Window is set to +250 mv. That is, the process starts at \$83F and carries on to \$820. It first sets \$83F, monitors the Trcnt Pin and checks if 5 Trcnt were detected during 10 ms. If Yes, adjustment is complete, and if No, carry on lowering the Gain Switch 1 step at a time. Repeat the above process three times and set the Gain Adjustment Switch with the average value.

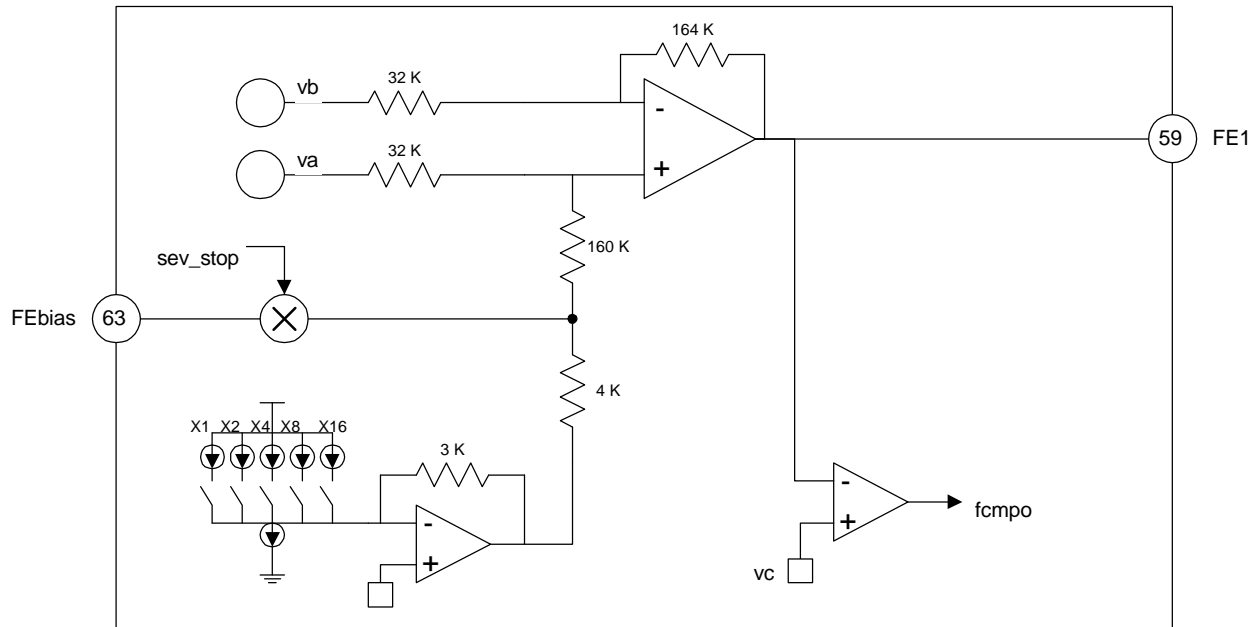
Gain Adjustment Flowchart 2



Tracking Gain Equivalent Resistance

Data	Tracking Gain										Note
	TERR Tot. Gain	TERR Gain	5bit Gain Ratio	Compared Value	Combination Value	5.0K	5.0K	2.5K	1.25K	0.75K	
S83F	0.108	96K / 32K -> 3.0 Times	0.036	10.0K	0.375K	1	1	1	1	1	The GAIN ratio is calculated in the TE1 pin.
S83E	0.303		0.101	10.0K	1.125K	1	1	1	1	0	
S83D	0.419		0.139	10.0K	1.625K	1	1	1	0	1	
S83C	0.575		1.191	10.0K	2.375K	1	1	1	0	0	
S83B	0.699		0.233	10.0K	2.875K	1	1	0	1	1	
S83A	0.798		0.266	10.0K	3.625K	1	1	0	1	0	
S839	0.876		0.292	10.0K	4.125K	1	1	0	0	1	
S838	0.981		0.327	10.0K	4.875K	1	1	0	0	0	
S837	1.048		0.349	10.0K	5.375K	1	0	1	1	1	
S836	1.139		0.379	10.0K	6.125K	1	0	1	1	0	
S835	1.195		0.398	10.0K	6.625K	1	0	1	0	1	
S834	1.273		0.424	10.0K	7.375K	1	0	1	0	0	
S833	1.321		0.440	10.0K	7.875K	1	0	0	1	1	
S832	1.389		0.463	10.0K	8.625K	1	0	0	1	0	
S831	1.431		0.477	10.0K	9.125K	1	0	0	0	1	
S830	1.490		0.496	10.0K	9.875K	1	0	0	0	0	
S82F	1.52		0.506	5.23K	5.375K	0	1	1	1	1	
S82E	1.618		0.539	5.23K	6.125K	0	1	1	1	0	
S82D	1.676		0.558	5.23K	6.625K	0	1	1	0	1	
S82C	1.755		0.585	5.23K	7.375K	0	1	1	0	0	
S82B	1.800		0.600	5.23K	7.875K	0	1	0	1	1	
S82A	1.8675		0.622	5.23K	8.625K	0	1	0	1	0	
S829	1.907		0.635	5.23K	9.125K	0	1	0	0	1	
S828	1.961		0.653	5.23K	9.875K	0	1	0	0	0	
S827	1.994		0.664	5.23K	10.375K	0	0	1	1	1	
S826	2.040		0.680	5.23K	11.125K	0	0	1	1	0	
S825	2.069		0.689	5.23K	11.625K	0	0	1	0	1	
S824	2.108		0.702	5.23K	12.375K	0	0	1	0	0	
S823	2.133	0.711	5.23K	12.875K	0	0	0	1	1		
S822	2.167	0.722	5.23K	13.625K	0	0	0	1	0		
S821	2.188	0.729	5.23K	14.125K	0	0	0	0	1		
S820	2.219	0.739	5.23K	14.875K	0	0	0	0	0		

## FEBIAS OFFSET ADJUST



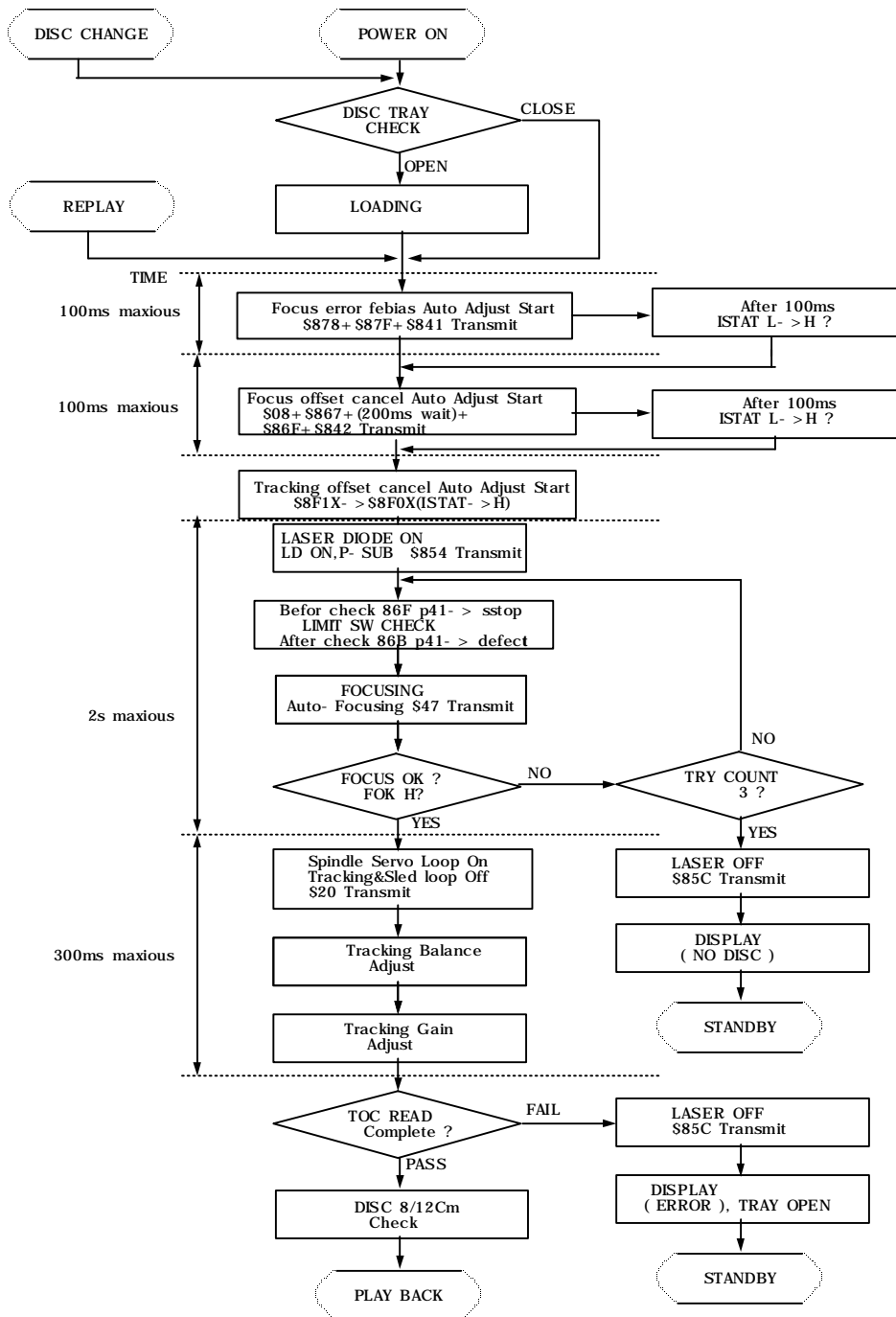
MICOM sends the Febias Offset Adjust Command \$841 to start the adjustment. In the Focus Error Amp Final output block, the Focus output is compared with the  $1/2 V_{DD}$ . If the Focus Error Amp output goes above  $1/2 V_{DD}$ , the Febias offset adjust is completed. The Focus Offset Adjusts voltage change per step is about 17 mv. Transition is carried out 1 step at a time from 112 mv to -112 mv by the total 5-bit resistance DAC, and after completion, about -8 mv of Offset is added to  $1/2$  step. Normally, the Offset distribution after Febias Offset adjust is between -8 mv ~ +8 mv. The design is such that after Focus Offset, you have the option to vary the Febias by turning On the switch that connects the exterior and interior of the Febias block (pin 63). This Control signal is Sev\_stop, and it is switched On after Focus Servo Offset adjust.

When Febias block is Open, the Focus Error Offset remains unchanged, the same as Febias Adjust Offset. The time spent per step is 5.8 ms, and since there are 5 bits, a total of 32 steps and maximum 256 ms can be spent. The Adjustment is carried out by Hardware, and it transitions from Minus Offset to Plus Offset.

For Febias Offset Readjust, 4-bit DAC is Reset by \$878, and Reset can be canceled only when the \$87F-applied D2 bit goes from 0 --> 1.

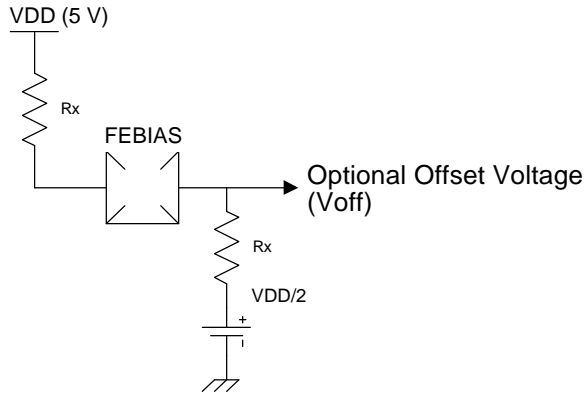
In order to prevent system errors such as static electricity, the Febias DAC Latch Blocks Reset is not carried out by the RESET block (System Reset), but by MICOM DATA.

Example of System Control Program



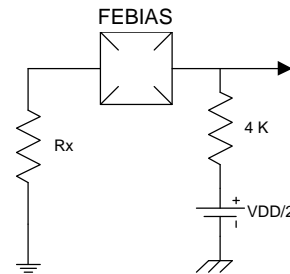
FEbias Offset Setting

\* Application when adjusting offset from 0 mV ~ +100 mV



$$\frac{VDD - VDD/2}{(Rx + 4 K)} = Voff$$

\* Application when adjusting offset from -100 mV ~ 0 mV



Example) When Power is 5 V

$$\frac{(5 - 2.5) V}{(Rx + 4 K)} 4 K = Voff$$

$$\frac{10 K}{(Rx + 4 K)} = Voff$$

### Focus Offset Adjust

MICOM sends the Focus Offset Adjust Command \$842 to start the adjustment. In the Focus Error Amp Final output block, the Focus output is compared with the 1/2 Vdd. If the Focus Error Amp output goes above 1/2 VDD, the Focus offset adjust is completed. The Focus Offset Adjusts voltage change per step is about 40 mv. Transition is carried out 1 step at a time from 320 mv to -320 mv by the total 4-bit resistance DAC, and after completion, about +20 mV of Offset is added to 1/2 step. Normally, the Offset distribution after Focus Offset adjust exists between -20 mv ~ +20 mv. The design is such that after Focus Offset, you have the option to vary the Focus by turning On the switch that connects the exterior and interior of the Focus block (pin 63).

When Febias block is Open, the Focus Error Offset is the same as Febias Adjust Offset. The time spent per step is 5.8 ms, and since there are 4 bits, a total of 16 steps and maximum 128 ms can be spent. Also, Lens-collision-sounds can be generated when adjusting the pick-up with a sensitive Focus Actuator, so the Time division that uses 46 ms per step, spending a total of 736 ms, is used. That is carried out by setting the \$86Xs lowest D0 bit to 0. The Adjustment is carried out by Hardware, and it goes from Minus Offset to Plus Offset.

For Febias Offset Readjust, 4-bit DAC is Reset by \$878, and Reset can be canceled only when the \$87F-applied D2 bit goes from 0 --> 1.

In order to prevent system errors such as static electricity, the Focus DAC Latch Blocks Reset is not carried out by the RESET block (System Reset), but by MICOM DATA.

### FEBIAS Adjust

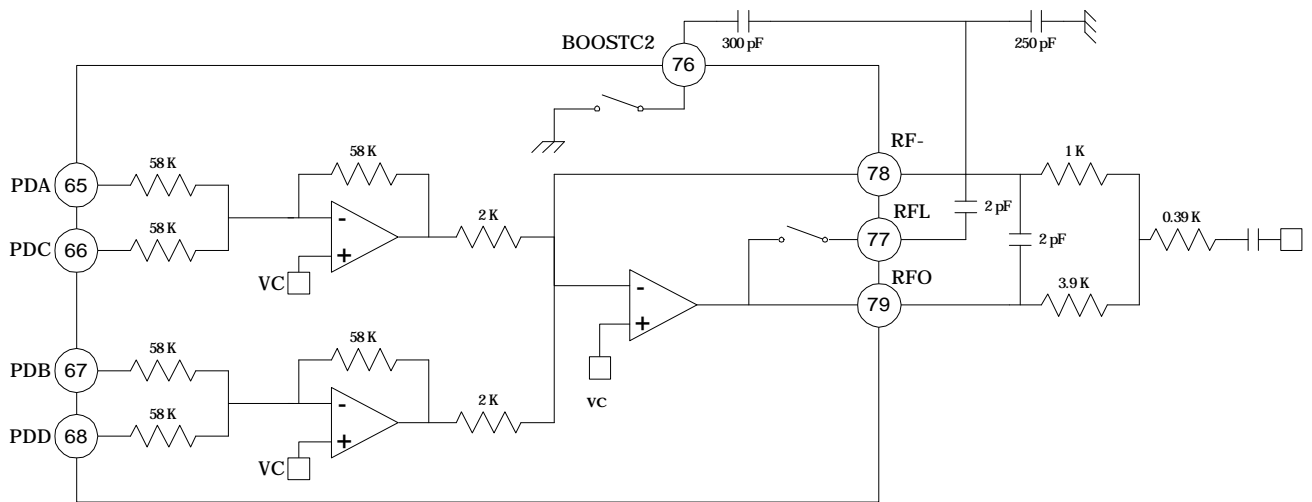
FEBIAS OFFSET is automatically adjusted from 0 mV, and can be adjusted from the exterior at +/-100 mV. When adjusting the FEBIAS at 0 mV ~ +100 mV, Rx connect to VDD, and if adjusting the FEBIAS at -100 mV ~ 0 mV, Rx connect to GND.

After FEBIAS OFFSET automatic adjust is complete, the FEBIAS external resistance and FOCUS ERROR internal resistance is connected, so adjusting Pin 63 (FEBIAS) to an optional OFFSET value is possible.

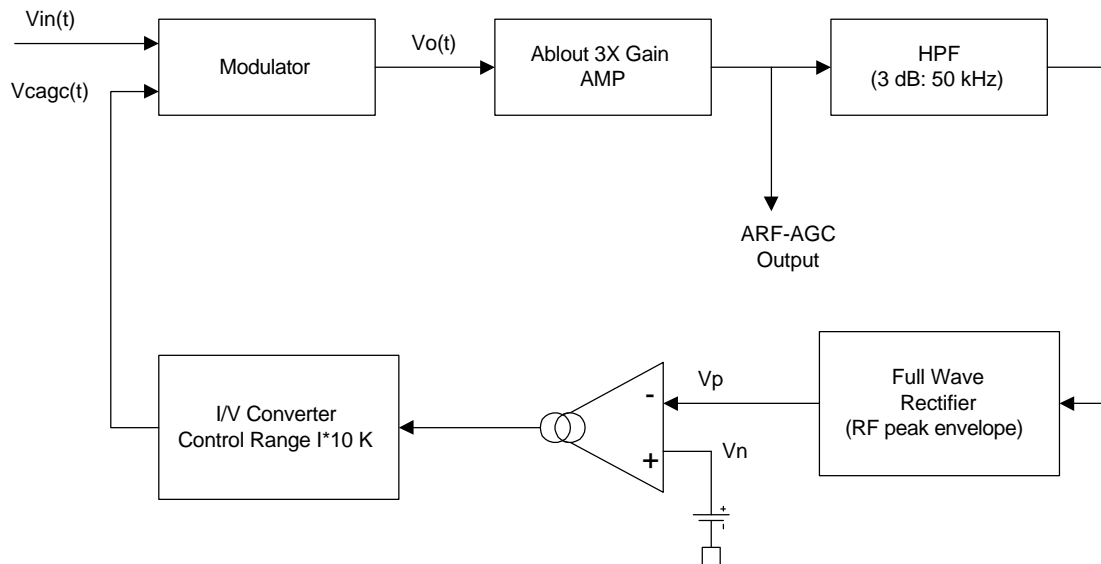
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11. RF SUMMING AMPLIFIER APPLICATION

The internal switch is for selecting the 1, 2x speed-related filter. It is On when 1x, and Off when 2x. Please adjust the according to the Set.



## RF EQUALIZE & AGC



The Modulator output is the product of the input and  $V_{cagc}$  Tanh Term. It goes through about 3x of Gain Blocks, then is output to the ARF Pad. The output goes through the HPF with the pole frequency of 50 kHz, then is full-wave rectified to follow-up the RF Levels Peak Envelope.

At this time, the HPFs Pole frequency is set to 50 kHz so that the 3t~11t frequency components can pass without diminution. After full-wave rectification, the RF levels Peak value is integrated to the 115pf CAP Node. If this peak voltage is smaller than the pre-determined voltage, it outputs a sinking current, and if larger, it outputs a sourcing current. The maximum current peak value is 10 uA, and this current is I/V converted and applied as a Modulator Control Voltage.

When Sinking, the voltage of  $V_{cagc}$  is increased up to  $I_{out} \times 10 K$  and multiplied with  $\text{Tanh}(1-X)$ , and when Sourcing, the voltage of  $V_{cagc}$  is decreased to  $I_{out} \times 10 K$  and multiplied with  $\text{Tanh}(1+X)$ . At this time, X is  $(V_{cagc} / 2V_t)$ .

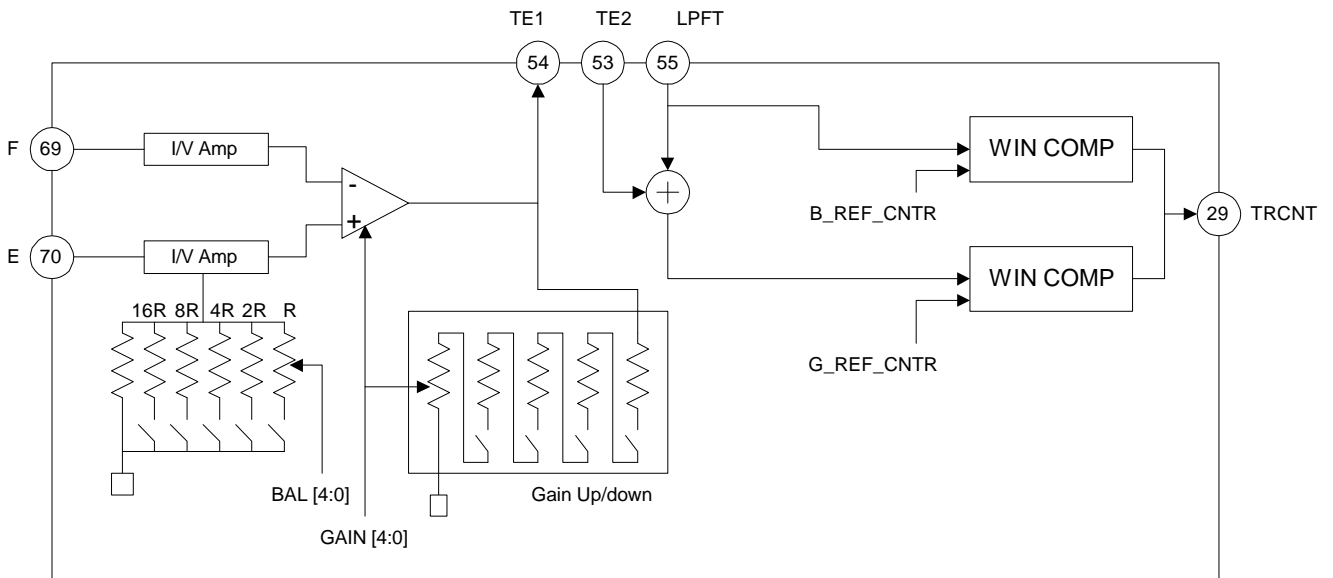
Overall, after detecting the 3t and 11ts level by full-wave rectification, it is compared to Tanh using the Modulator and multiplied to the Gain to realize the wave-form Equalize. The above is related to the AGC concept, which means that a specific RF level is always taken.

## OTHER BLOCK

### 13.1 TRACKING ERROR AMPLIFIER

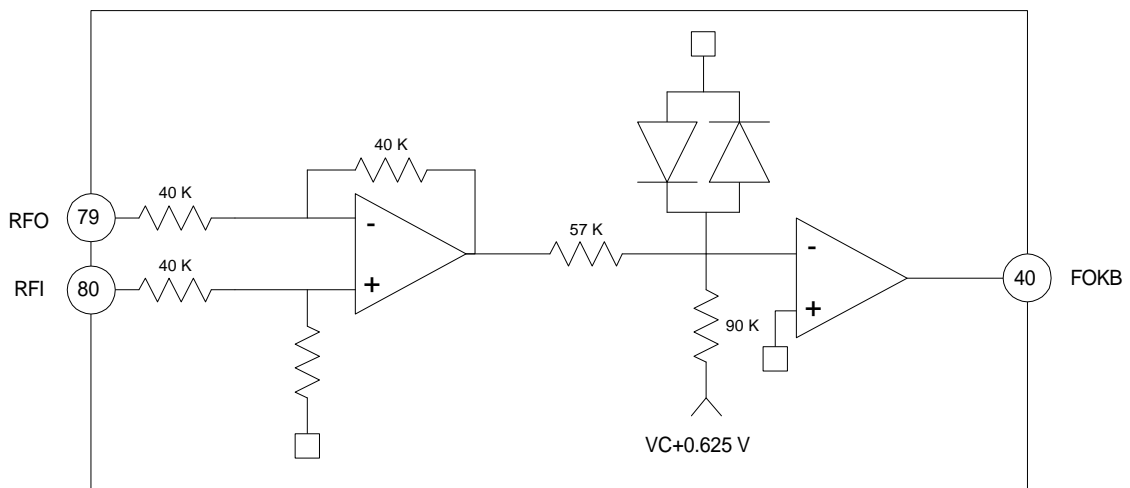
The Side Spot Photo Diode current which is input into blocks E and F, goes through the E Loop I-V and F Loop I-V Amp. It is then converted into voltage, in order to gain the difference signal in the Tracking Error Amp. It is MICOM

programmed so that the balance is adjusted in E block, and gain is automatically adjusted in Te1.



**FOCUS OK CIRCUIT**

The Focus OK Circuit compares the DC difference value between the Rfi and Rfo blocks to the standard DC value. If the Rf level is above standard, Fok outputs L->h to make a Timing Window for turning the Focus On during Focus Search status.

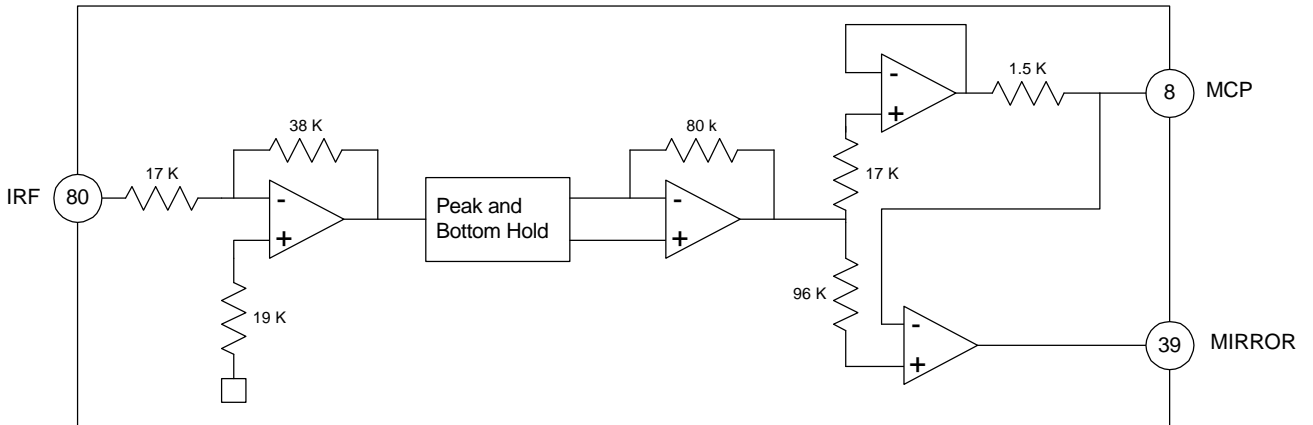


**MIRROR CIRCUIT**

The Mirror signal amplifies the RFI signal, then Peak and Bottom Holds it. Peak Hold can follow-up on Defect-type Traverse, and Bottom Hold can follow-up on Rf Envelope to count the Tracks. The Mirror output is the following: L

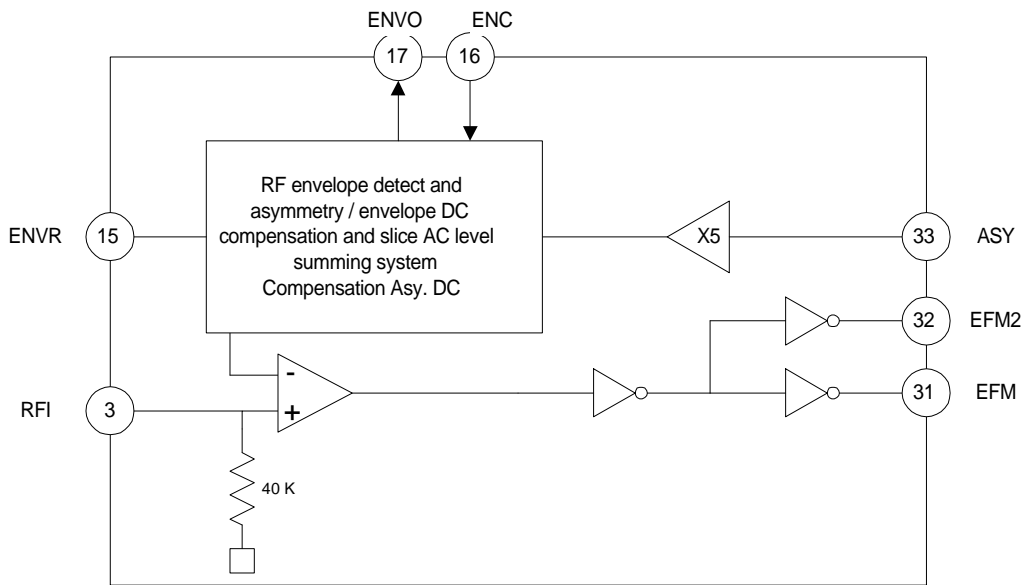


within Disc tracks, H between tracks, and H when a defect above 1.4 ms is detected.



**EFM COMPARATOR**

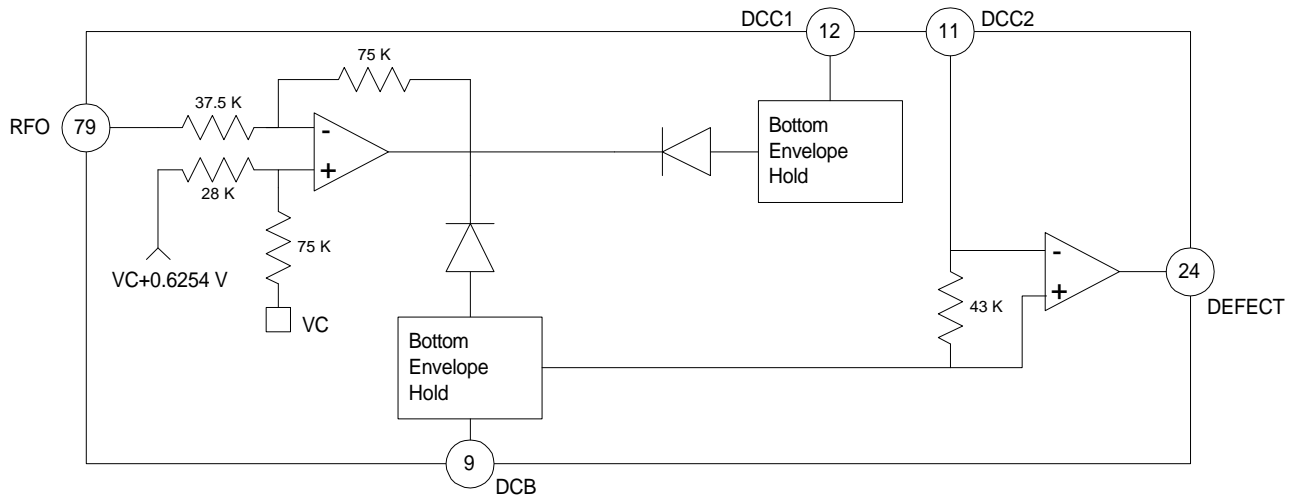
The EFM Comparator makes the Rf signal into a secondary signal. The Asymmetry generated by a fault during Disc production cannot be eliminated by only AC coupling, so control the standard voltage of the EFM Comparator to eliminate it.



**DEFECT CIRCUIT**

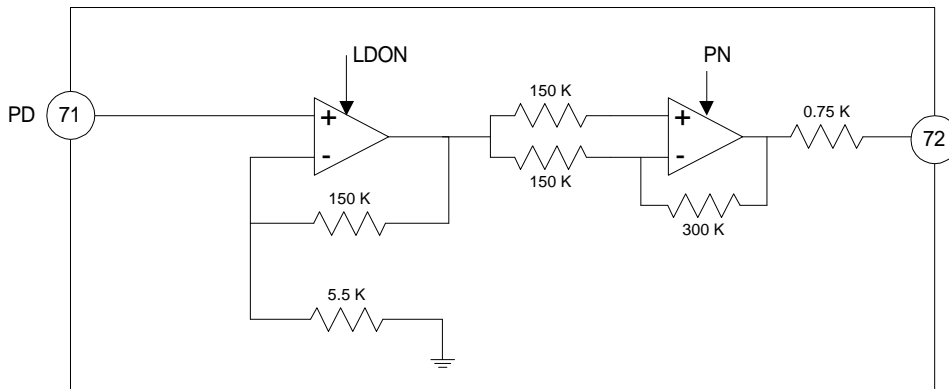
After Rfo signal inversion, Bottom Hold is carried out using only , , 2 . Except, the Bottom Hold of Holds the coupling level just before the coupling. Differentiate this with the Coupling, then Level Shift it. Compare the signals

to either direction to generate the Defect detect signal.



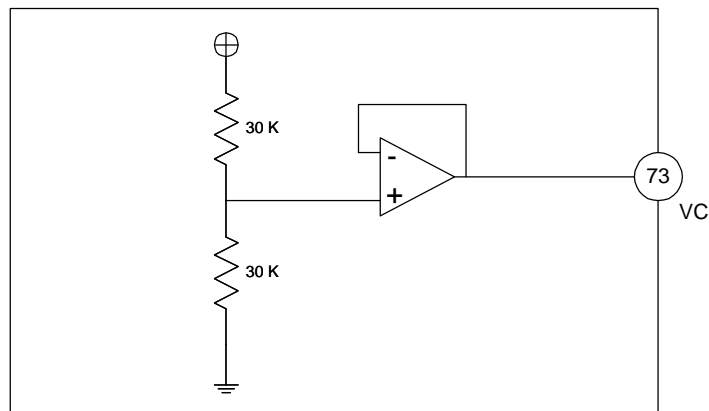
**APC CIRCUIT**

If you operate the Laser Diode in constant current, since it has a negative temperature characteristic with a large, it is controlled by the Monitor Photo Diode so that the output is kept regular.



**13.7 Center Voltage Generation Circuit**

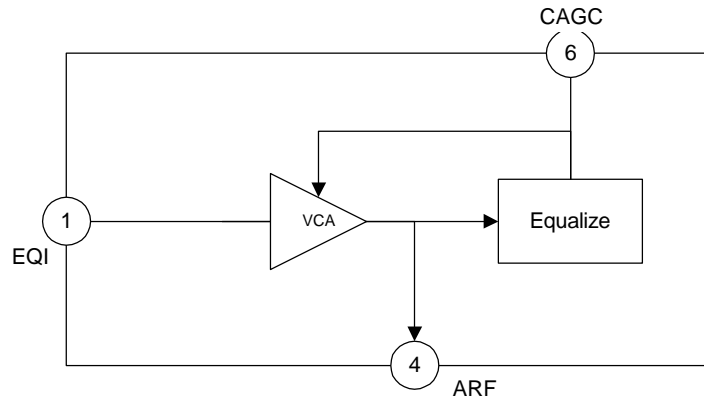
This circuit makes the Center Voltage using the Resistance Divide.



13.8 Rf Equalize Circuit

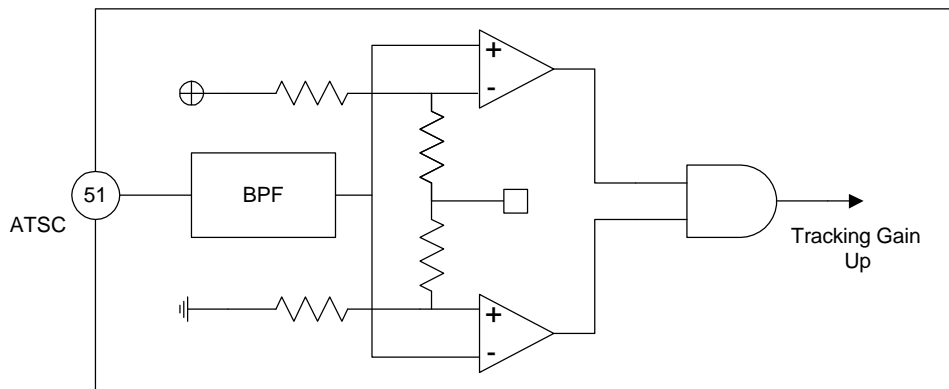
The AGC block maintains a steady Rf Peak to Peak level, and has a built-in 3t gain boost function. It detects the Rf Envelope and compares it with the standard voltage to perform comparison gain adjustment.

The received Rf output stabilizes the Rf Level to 1vp-p, and this output is applied as the EFM Slice input.



13.9 ATSC

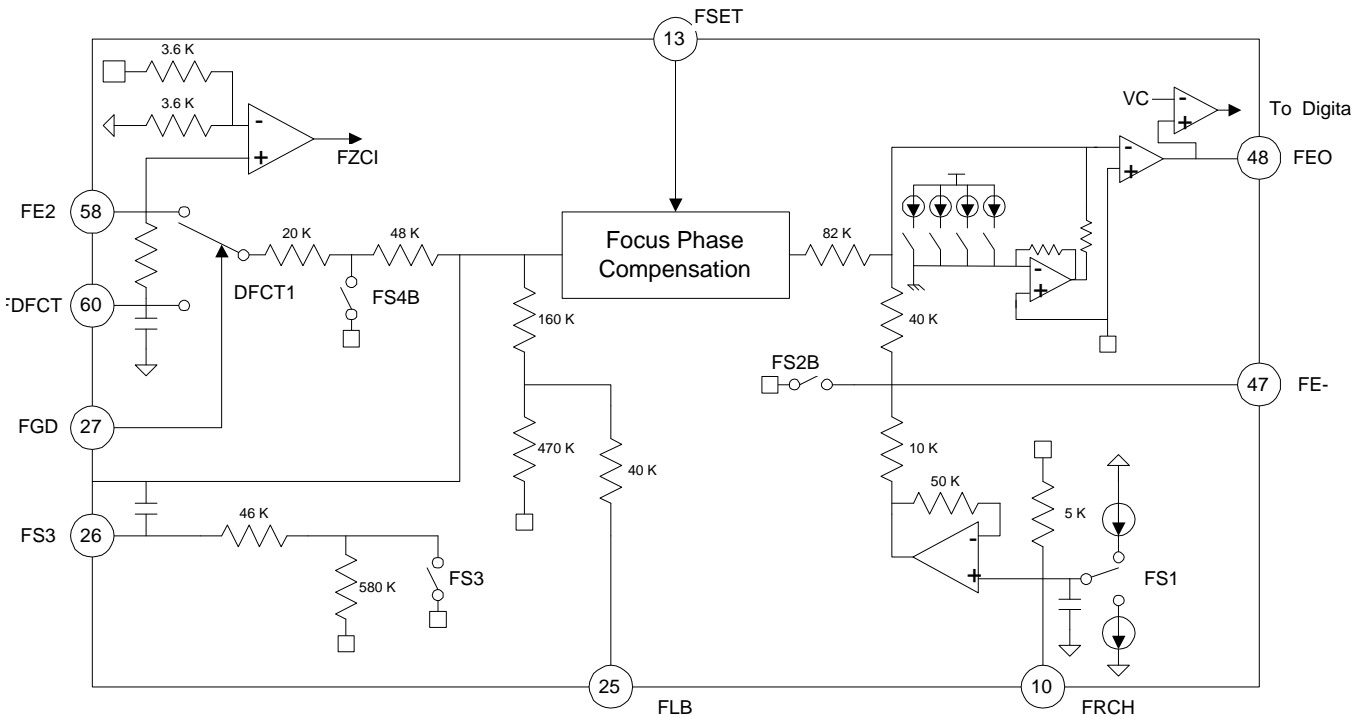
The Detect Circuit for the Tracking Gain Up (about Shock) is composed of a Window and a Comparator.



13.10 Focus Servo

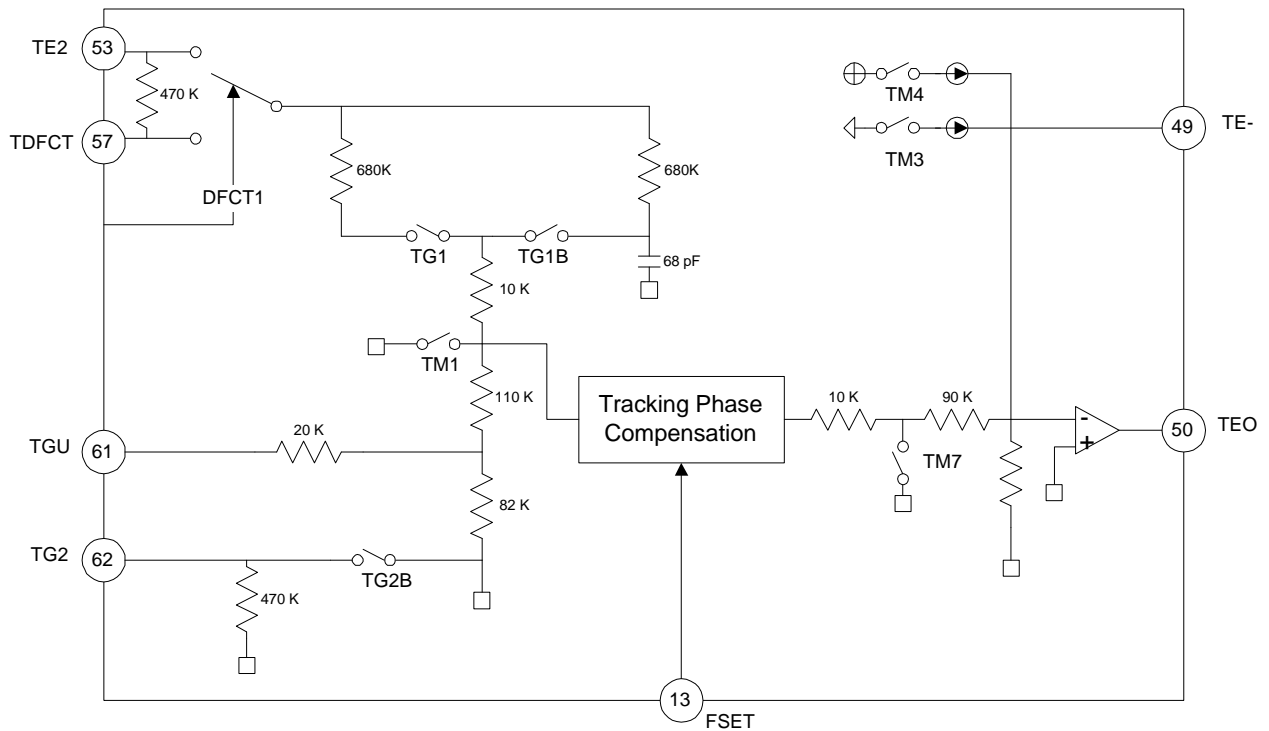
If set to phase compensate the Focus Servo Loop, the Focus Servo Loop is Muted when Defect is H. At this time, the Focus Error signal is integrated by the 0.1 uf Capacitor to be connected to the Fdct block, and the 470 resistance. It is then output through the Servo Loop. Therefore, during Defect, the Focus Error output is Held as the Error value before the Defect Error. The frequency which maximizes the Focus Loops phase compensation is changed by the Fset block. If the resistance is 510 kohm, the maximum frequency is 1.2 kHz, and is inversely proportional to the resistance.

When in Focus Search, Fs4 is On to intercept the Error signal. The Focus Search signal is output through the Feo block. When Focus is On, Fs2 is On, and the Focus Error signal input through the Fe2 block is output to the output pin through the Loop.



**TRACKING SERVO**

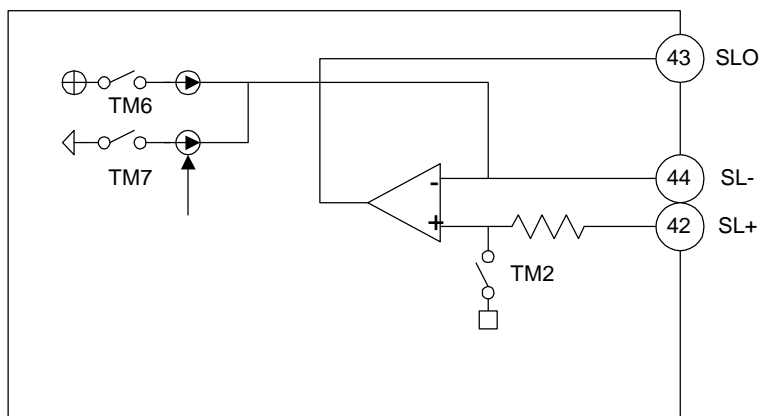
After Tracking Servo Loops Phase compensation and during Defect, the Tracking Error signal is integrated through 470 k resistance and the 0.1 uf Capacitor, then output through the Servo Loop. Rtg and Tg2 blocks are Tracking Gain Up/Down exchange blocks. In Phase Compensation, like Focus Loop, the Peak frequency of the phase compensation is varied by the Fset block. If the resistance connected to the Fset block changes, the Op Amp Dynamic Range and the Offset change as well.



The Tm7 Switch is a Brake Switch which turns the Tracking Loop On/Off when the Actuator is unstable after a Jump. After the Servo has jumped 10 tracks the Servo Circuit is out of the liner range, and sometimes the Actuator follows an unstable track. So this prevents unnecessary jumping caused by unwanted Tracking Errors. Tg2 and Tgu blocks adjust the Tracking Servo Loops high frequency Gain. It adjusts the gain of the wanted frequency band zone through the external Cap.

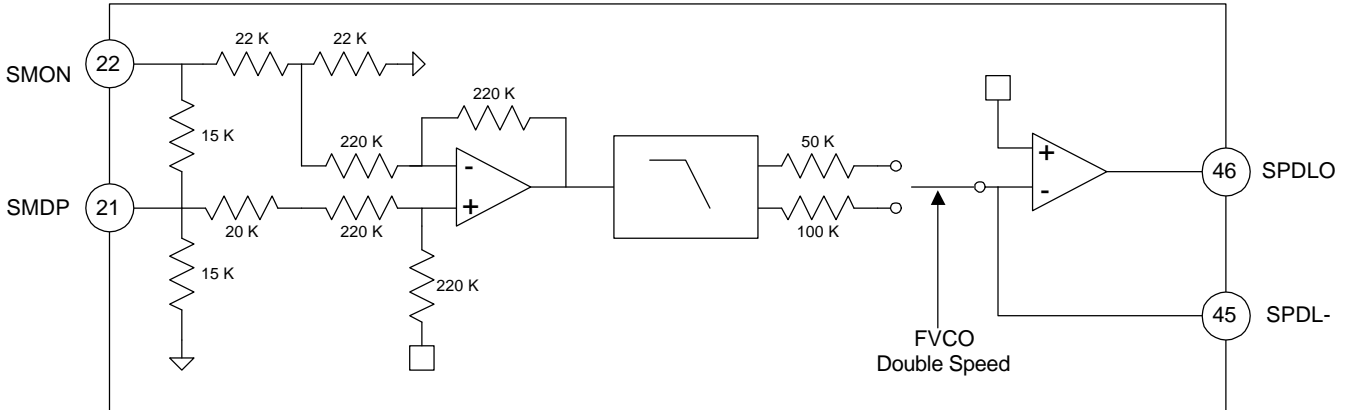
**SLED SERVO**

This servo integrates the Tracking Servo output to move the pick-up. Also, during Track movement, it outputs Sled Kick voltage for the Track Jump along the Sled axis.



**SPINDLE SERVO & LOW PASS FILTER**

200 Hz Lpf is configured by the 20 k resistance and 0.33 uf Cap in order to eliminate carrier components. Fsw becomes Low in Clv-s mode, so more powerful filter movements are carried out.



**ITEM1. Mirror Mute (Used for Tracking Mute Only)**

This circuit is used as an ABEX-725A countermeasure, which handles Tracking Muting when Mirror is detected. Its MIN and MAX are set, and it detects a minimum of 11 kHz to a maximum of 700 Hz.

Except, Mute does not function in the following four cases.

- When transmitting a MICOM tracking gain up command (TG1, TG2 = 1)
- When Anti-shock is detected (ATSC)
- When LOCK falls to L
- When DEFECT is detected

Mirror Mute Operating / APC P-sub	APC On	APC Off
Interruption On (Mirror 11 kHz~0.7 kHz)	\$854X	\$85CX
Interruption Off	\$855X	\$85DX
Interruption On (Mirror 2.75 kHz~0.7 kHz)	\$856X	\$85EX
Interruption On (Mirror 5.5 kHz~0.7 kHz)	\$857X	\$85FX

**ITEM2, TRCNT Output**

TRCNT is an output generated by Mirror and TZC. Mirror is a Track Movement Detect output by the Main Beam, and TZC is a Track Movement Detect output by Side Beam. TRCNT receives these 2 inputs and determines if the Pick-up is currently moving inwards or outwards to use it when in Tracking Brake of \$17.

