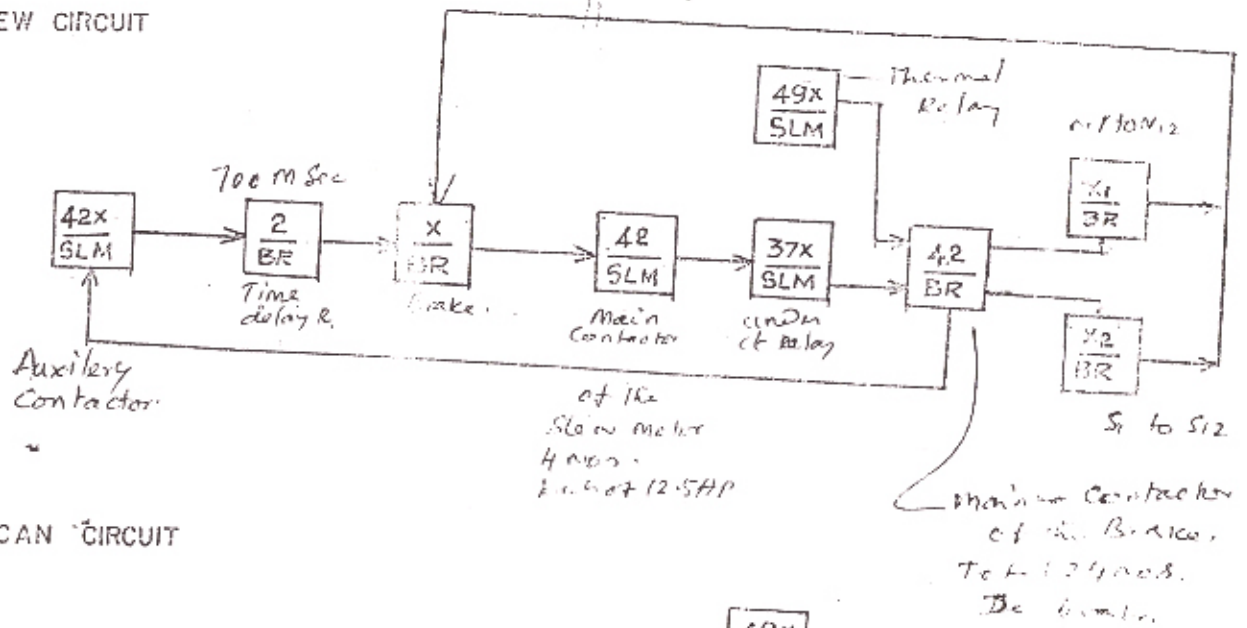


**ORT**  
**ELECTRICAL**  
**DRAWINGS**

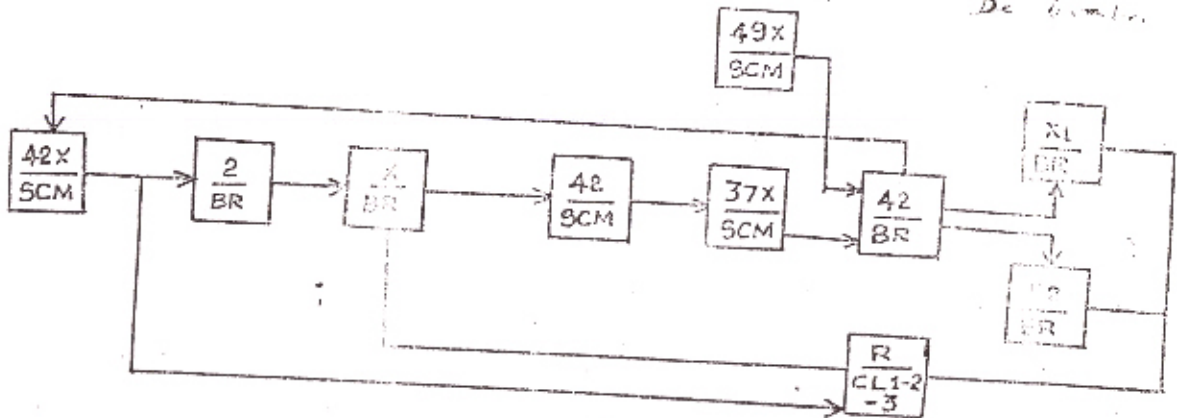


# GENERAL BLOCK DIAGRAMS

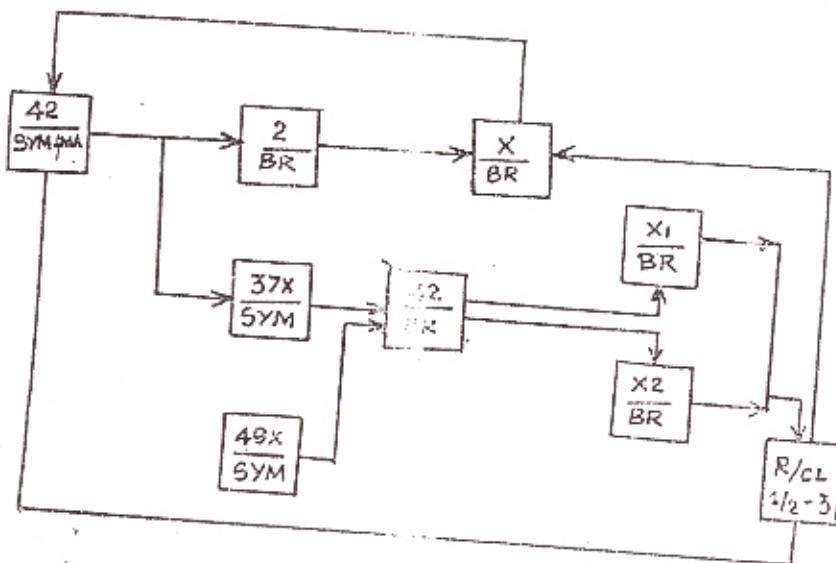
## 1. SLEW CIRCUIT



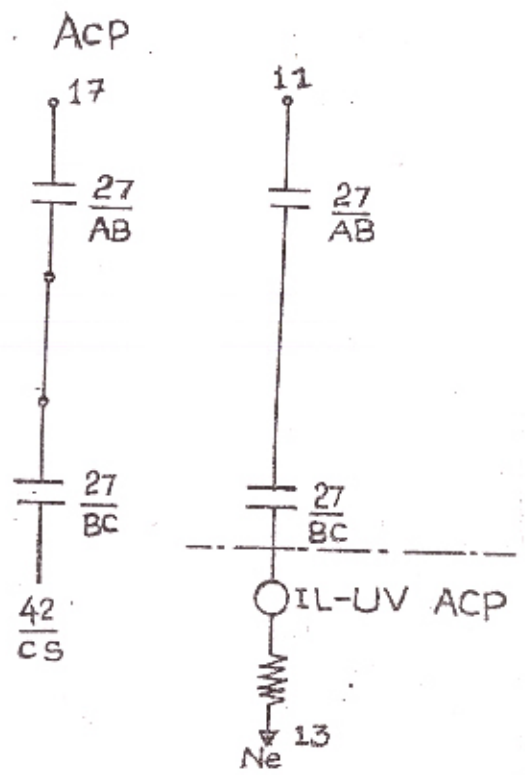
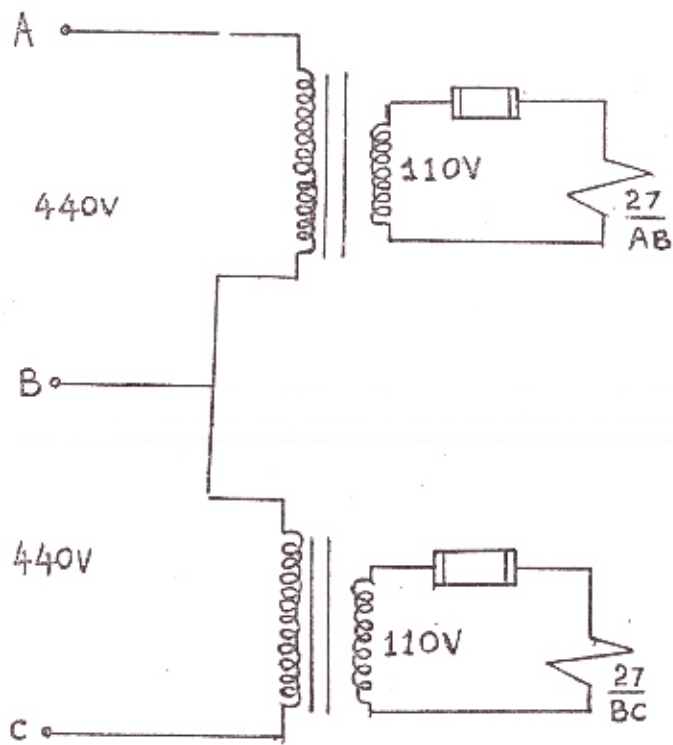
## 2. SCAN CIRCUIT



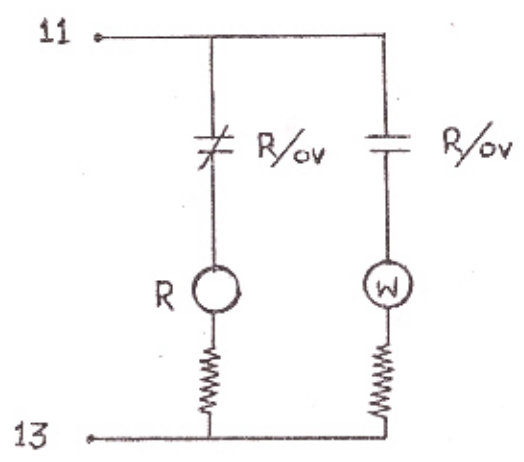
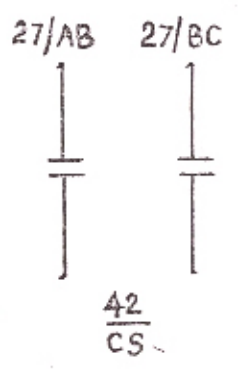
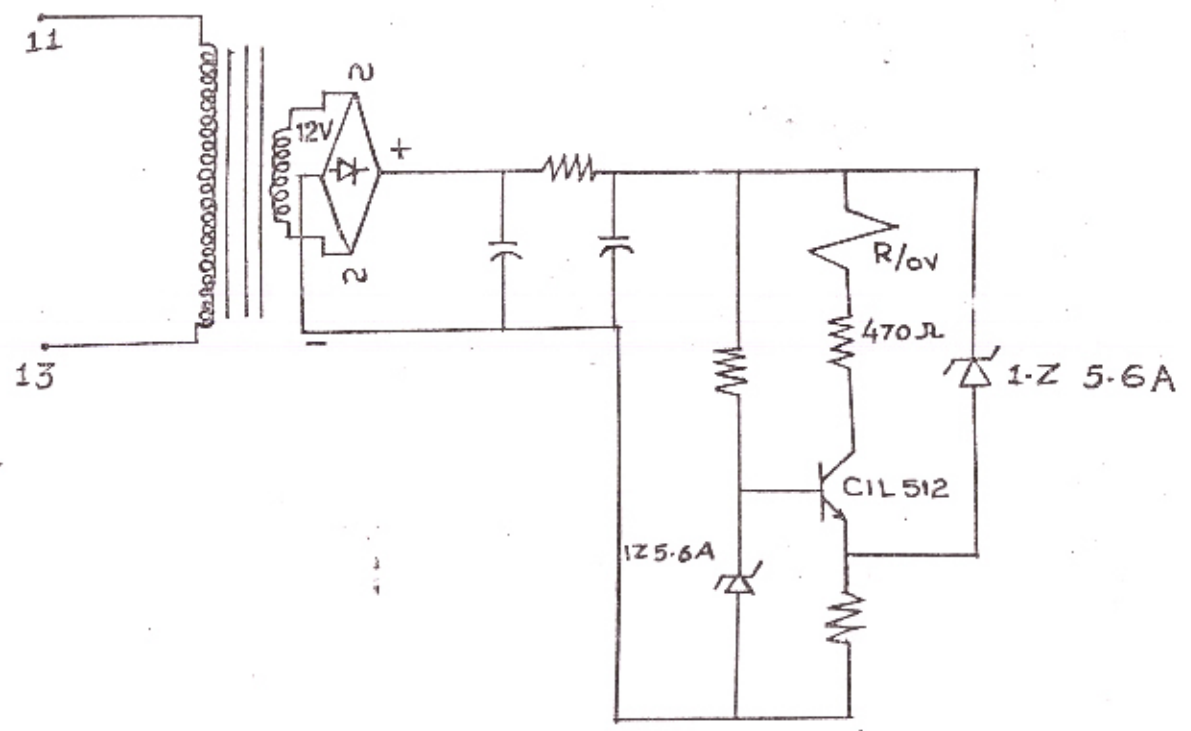
## 3. TRACK MAINS CIRCUIT



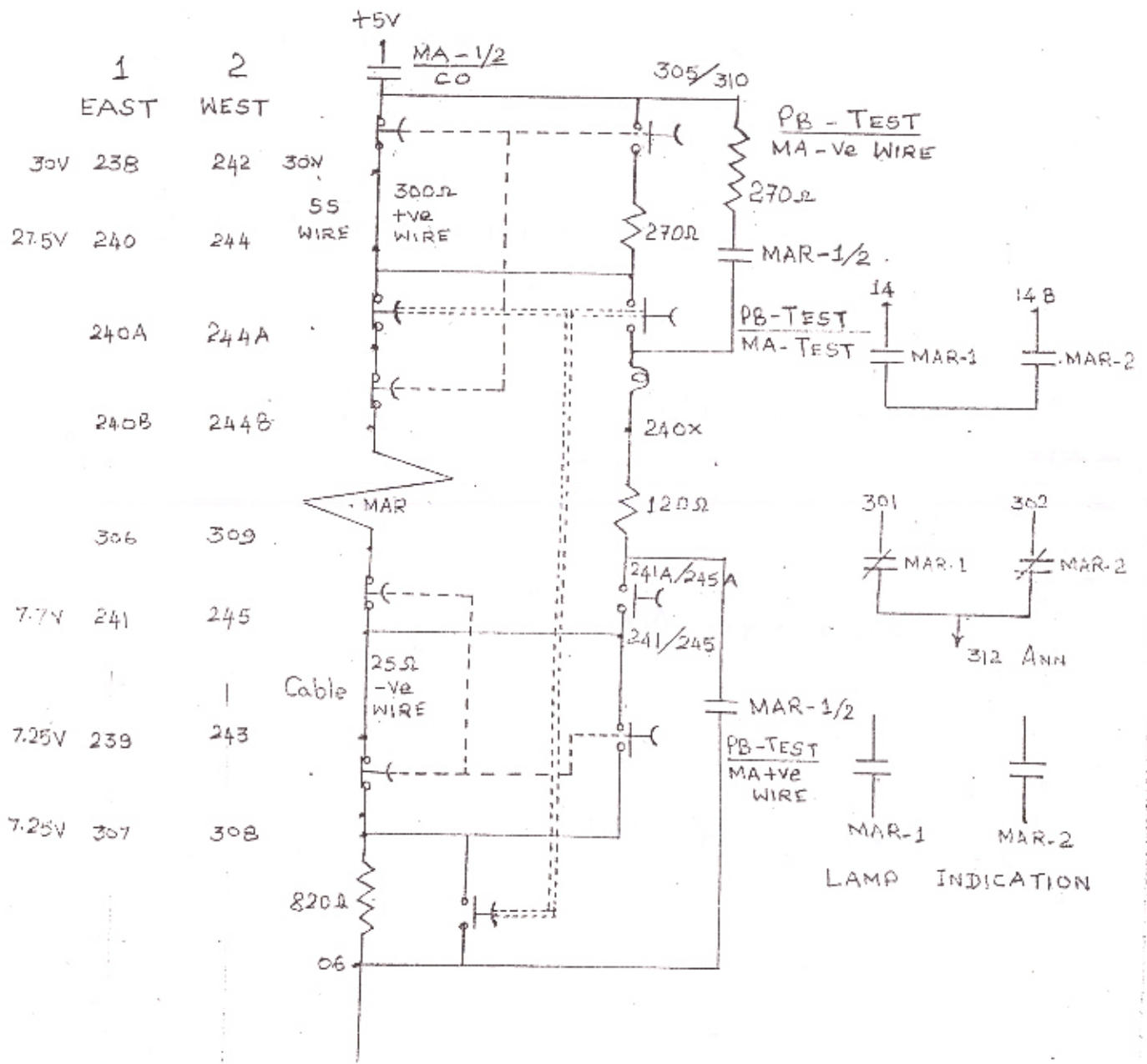
### 2.4) UNDER VOLTAGE RELAYS



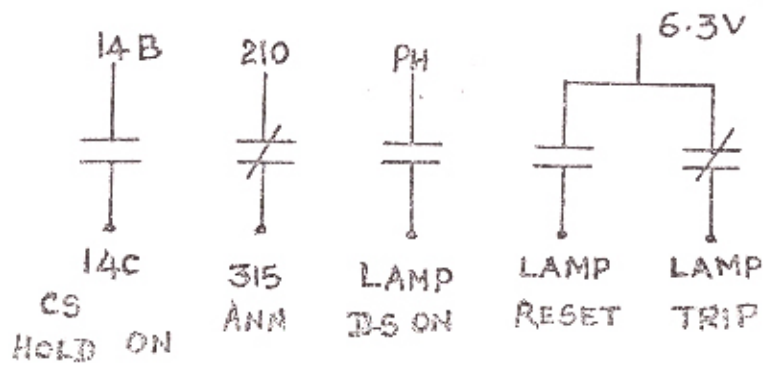
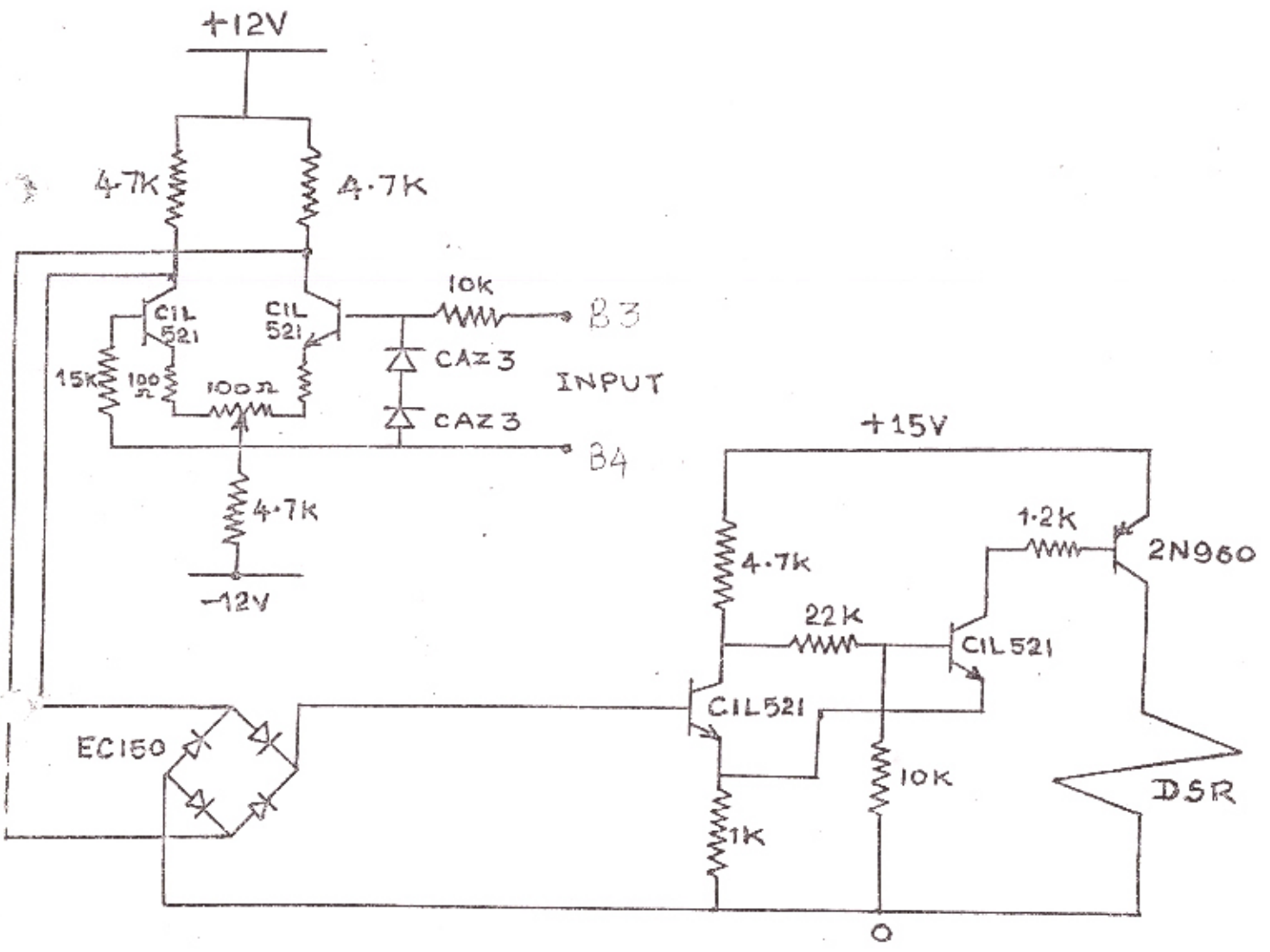
# OVER VOLTAGE PROTECTION CIRCUIT

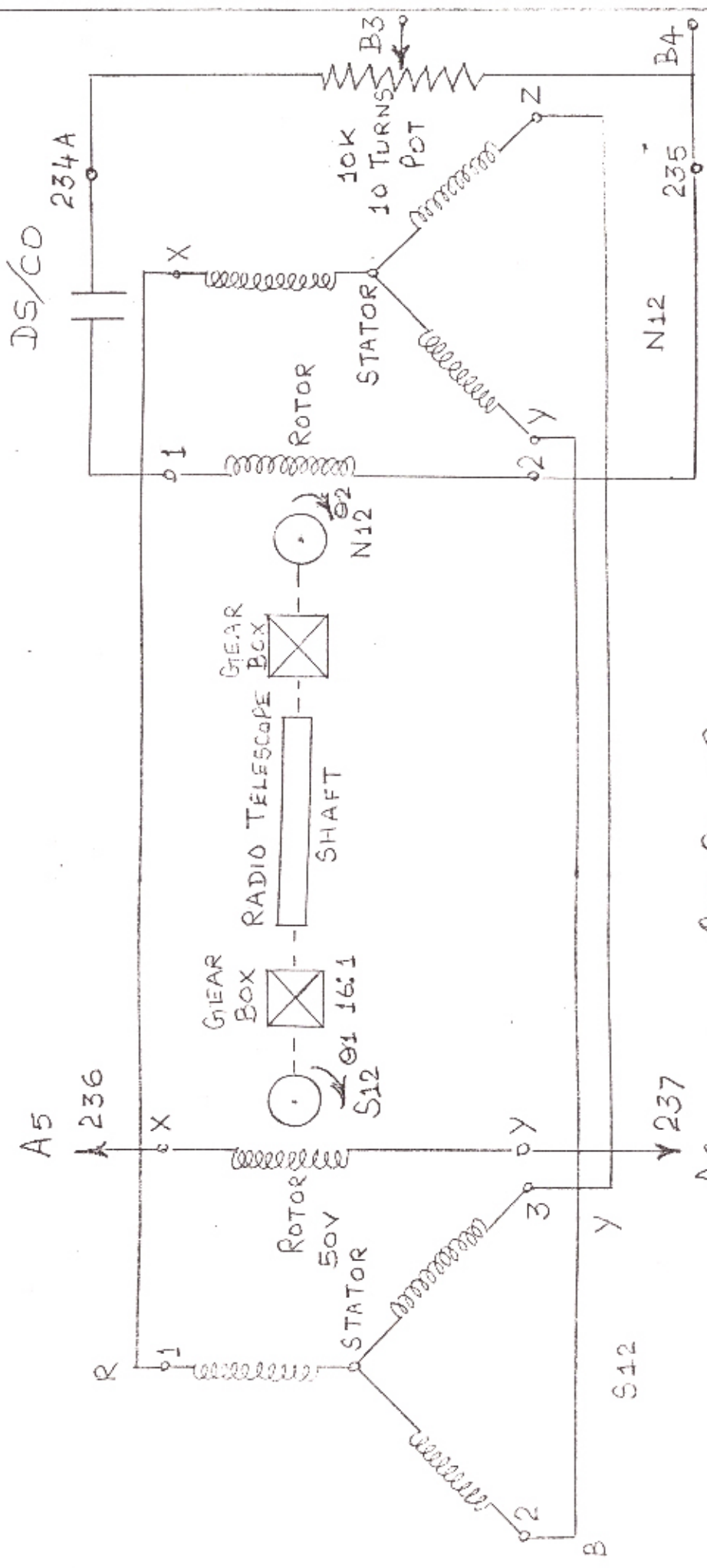


# MISALIGNMENT LOOP CIRCUIT



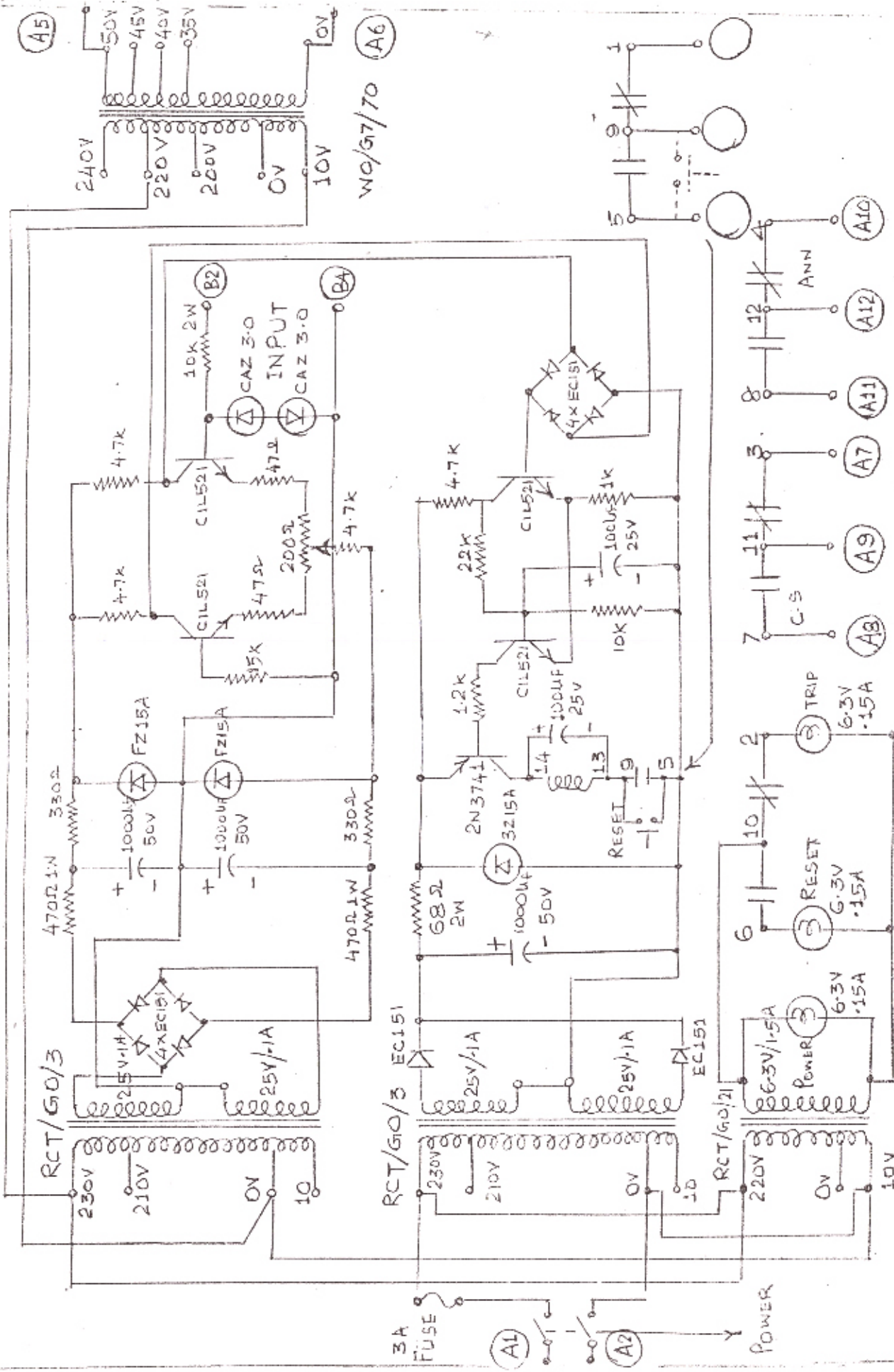
# DIFFERENTIAL SYNCHRO CIRCUIT





$\theta_{IN} \theta_2 = \theta$   
 $V_{signal} = V_{max} \sin \theta$  10V  
 CONNECTION DIAGRAM FOR  
 MISALIGNMENT DETECTOR

DRG NO: D-9904-I-427      DATE: 14-9-72



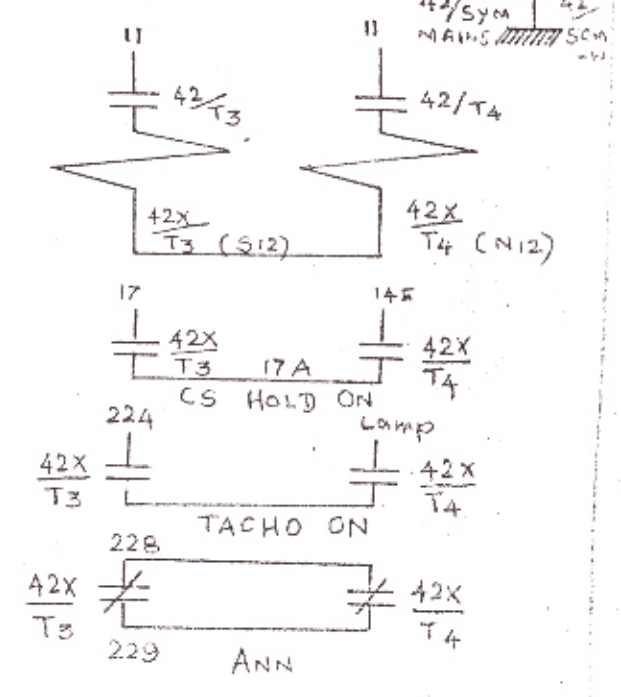
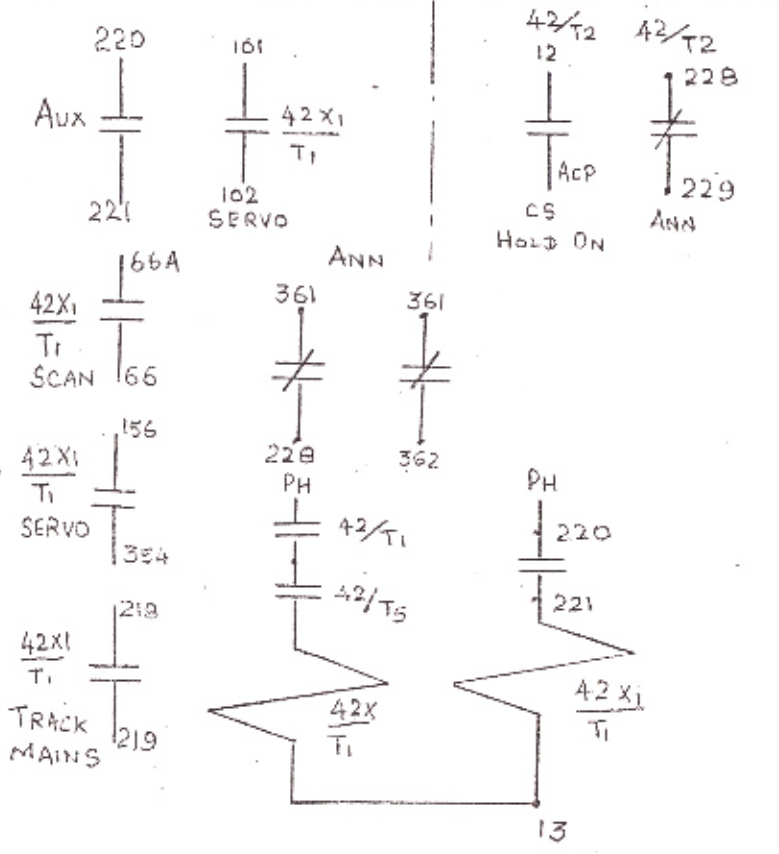
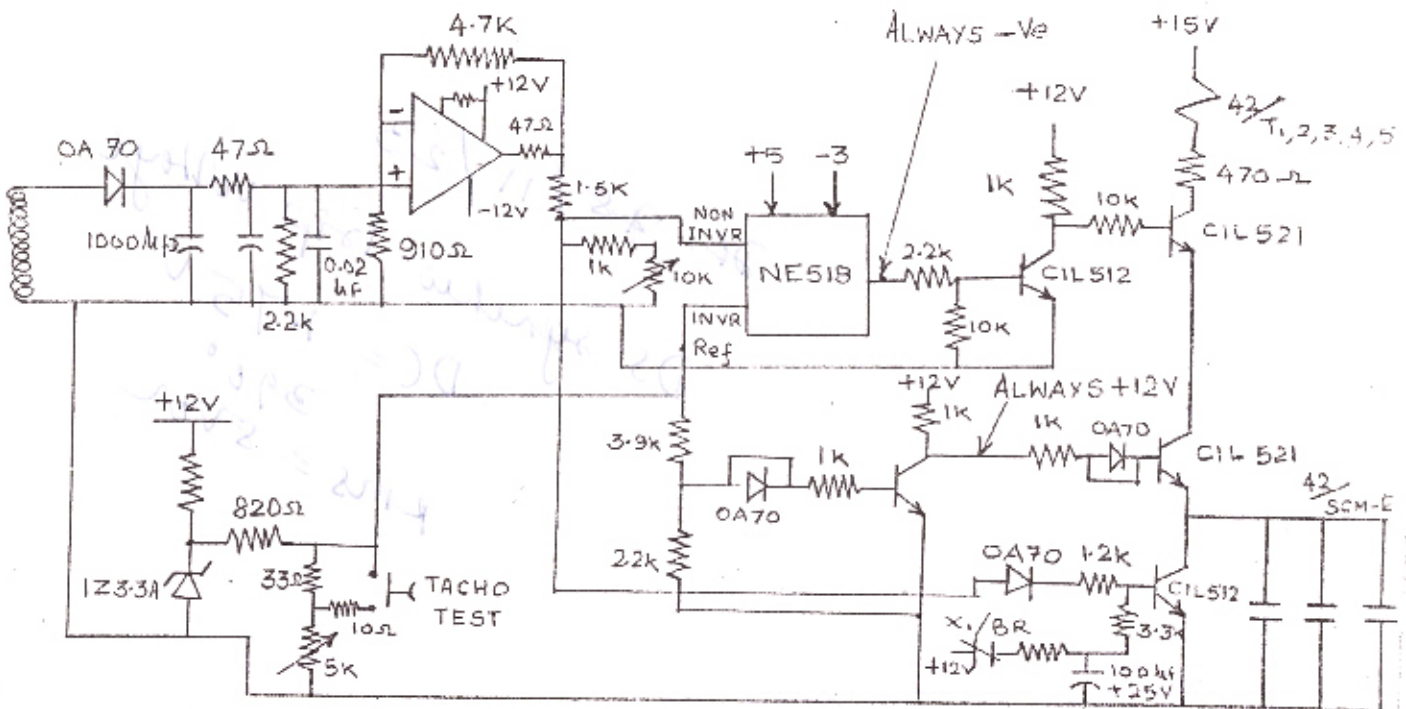
WO/57/70 (A6)

MISALIGNMENT DETECTOR

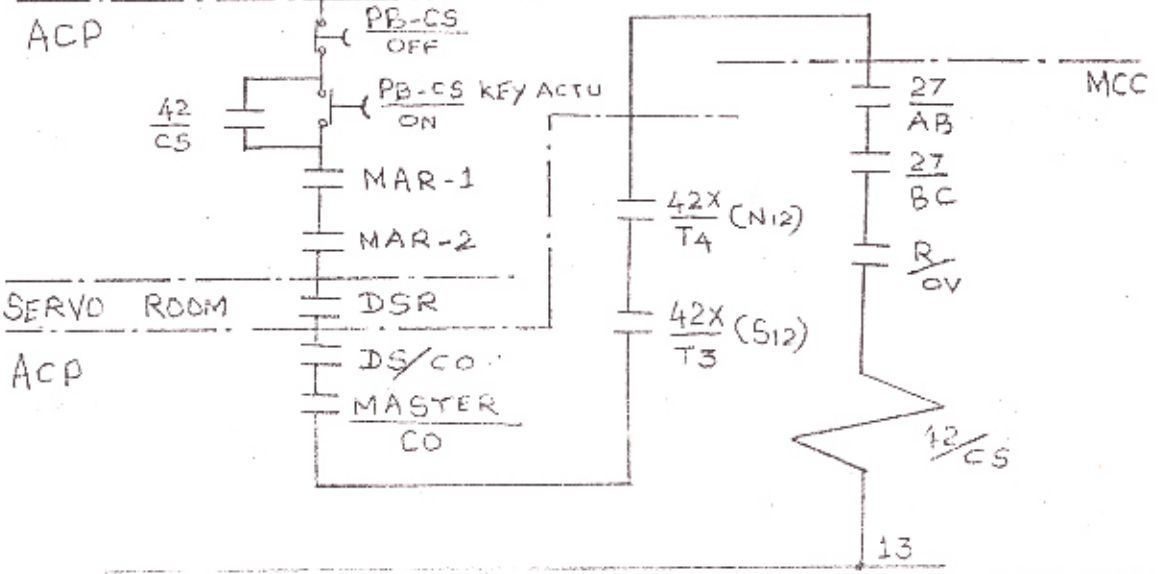
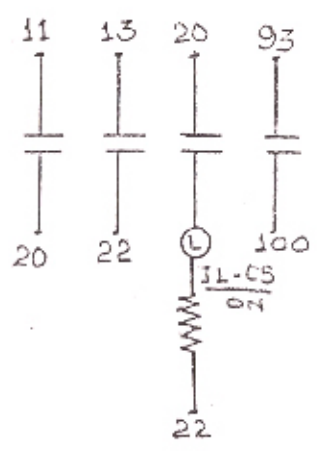
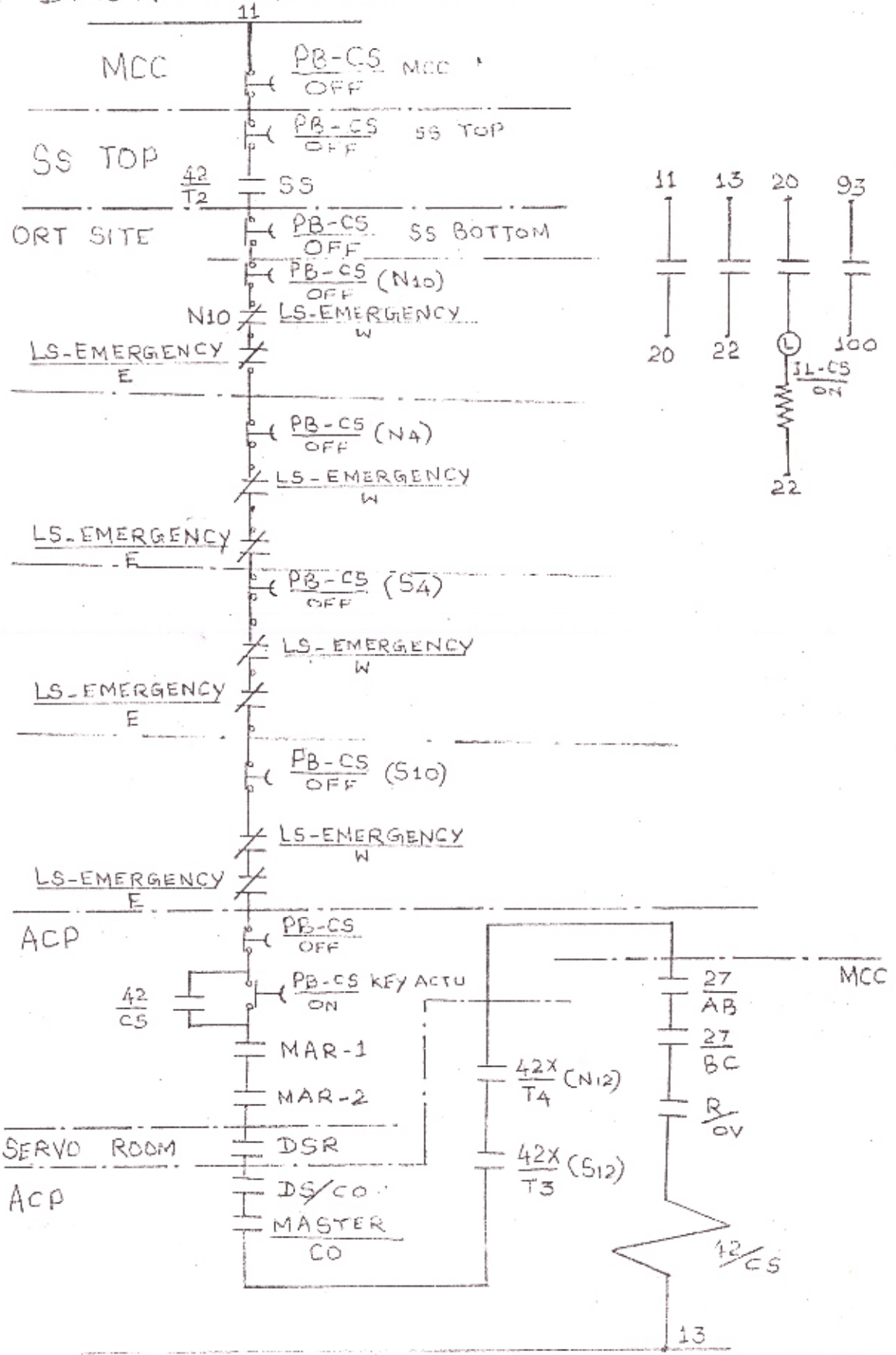
DRG. NO. D-9901-I-426 DATE 8-9-72



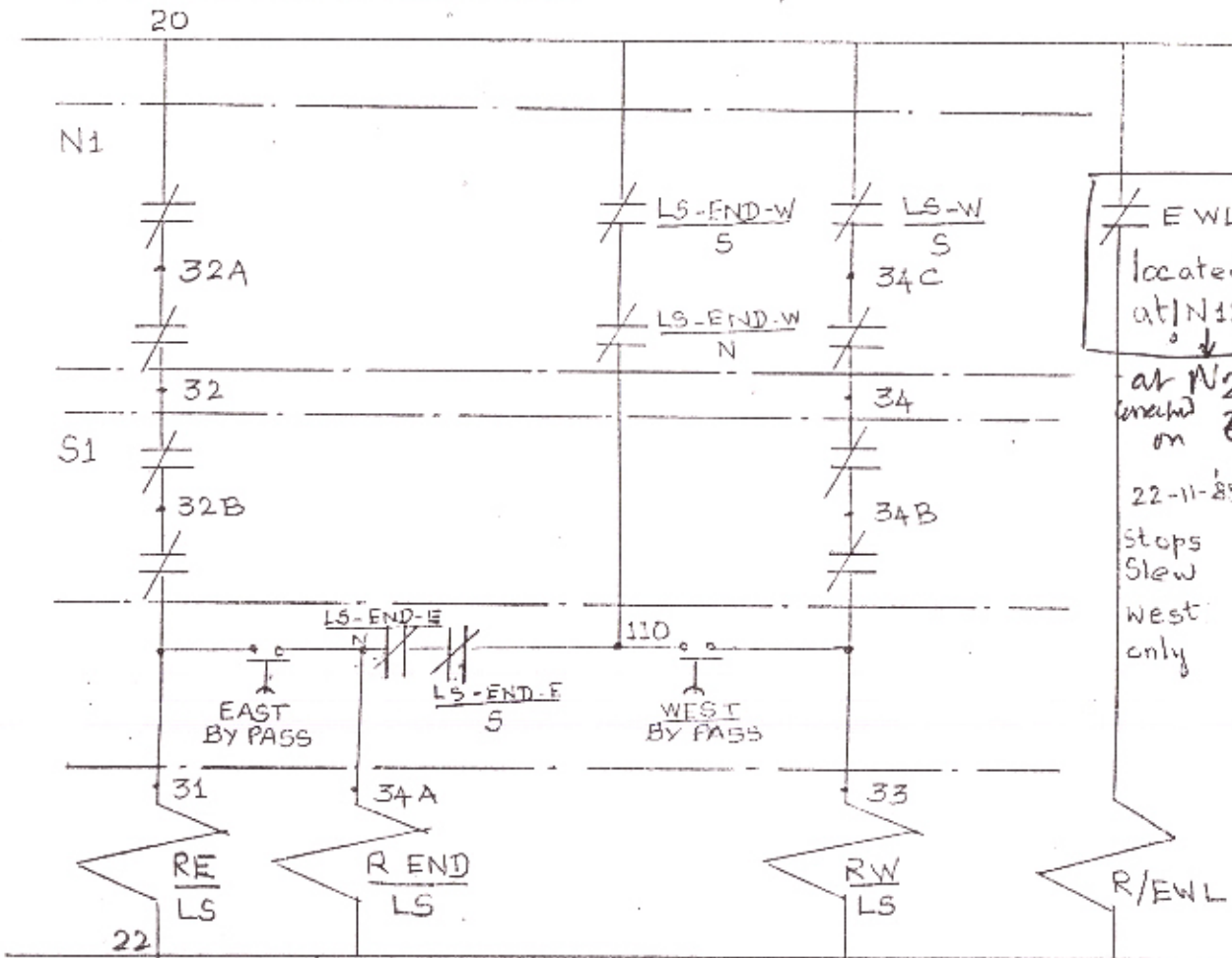
# OVERSPEED TACHO CIRCUIT



# LINE DIAGRAM CONTROL SUPPLY

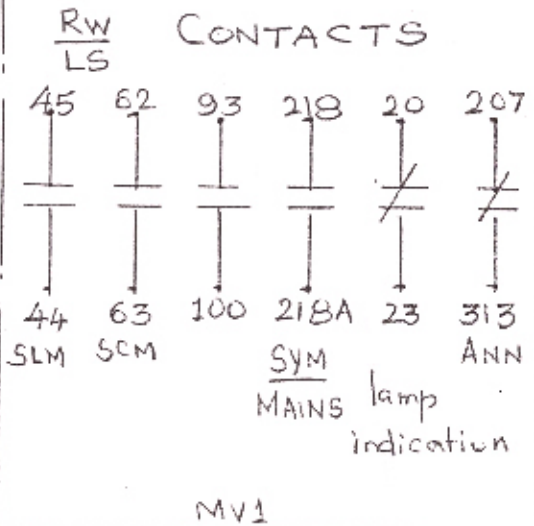
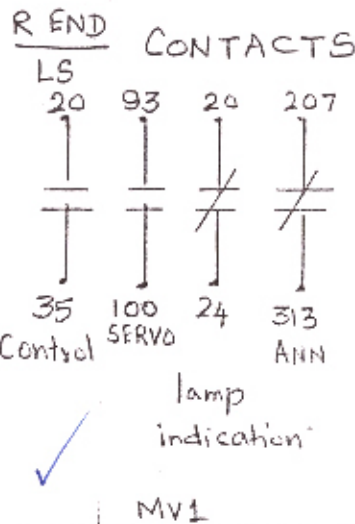
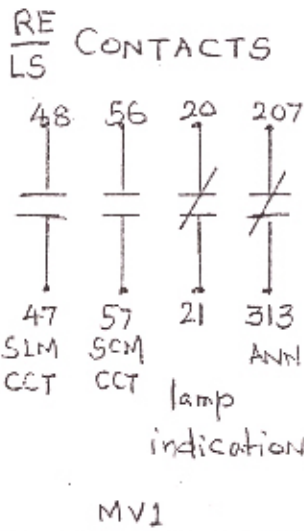


### 3. LIMIT SWITCHES

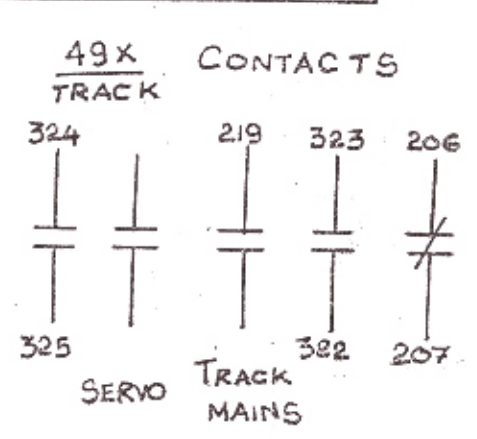
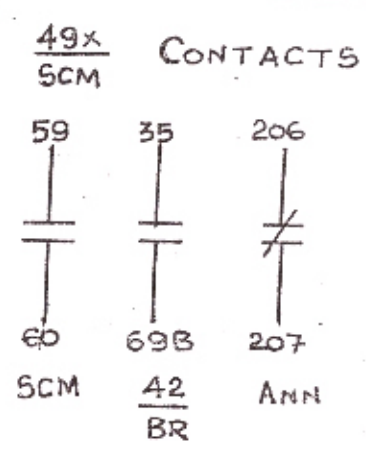
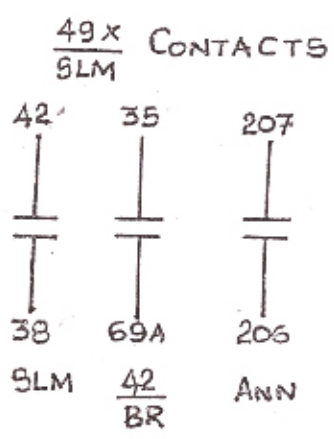
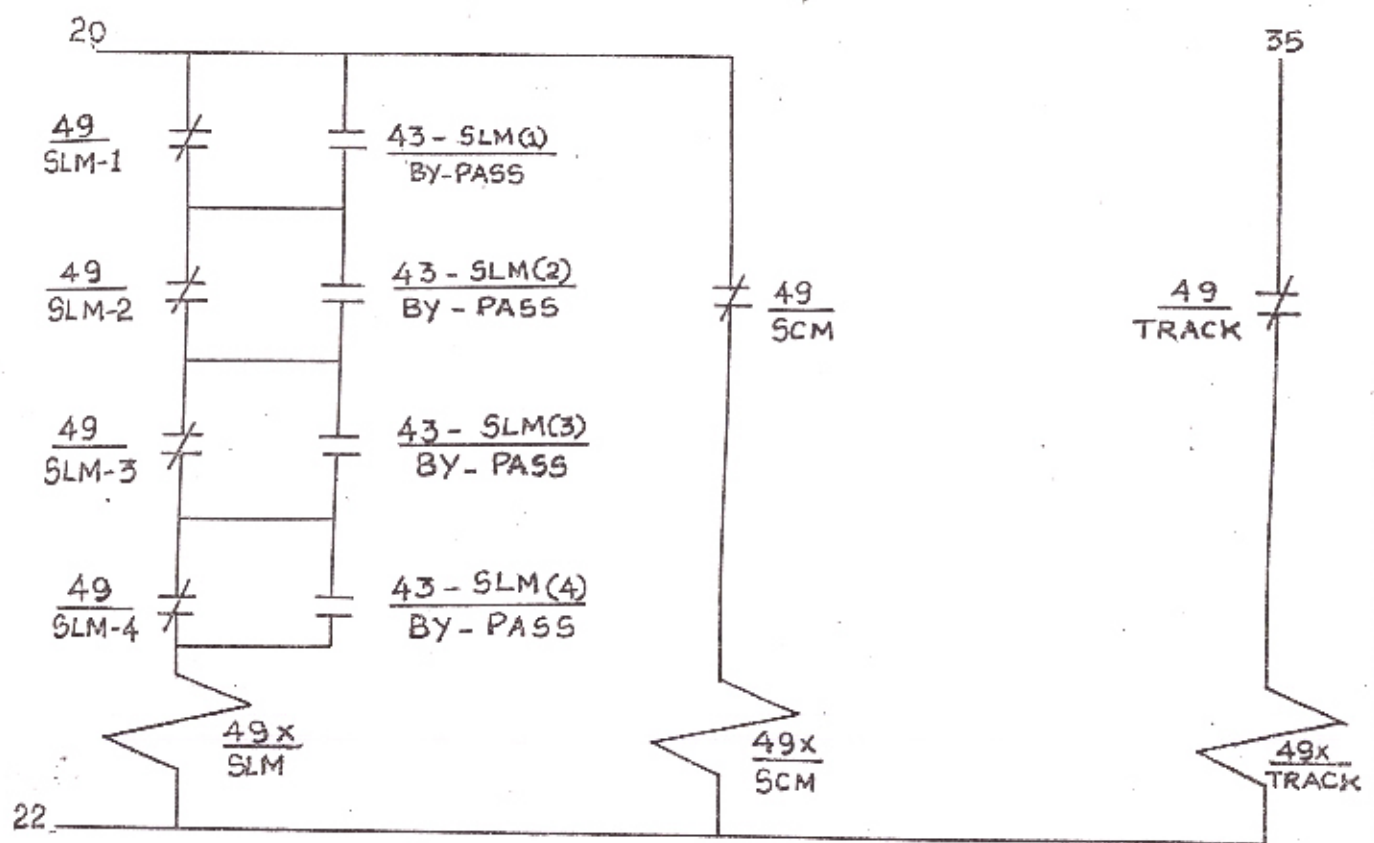


$\overline{EWL}$   
located  
at N12

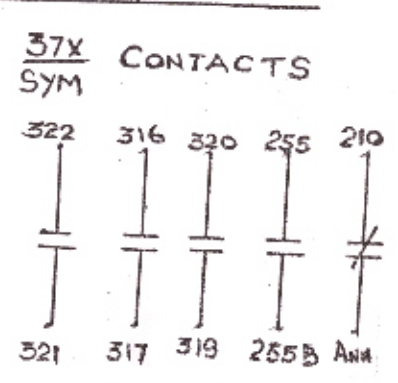
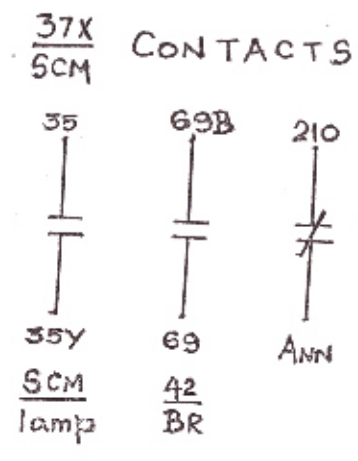
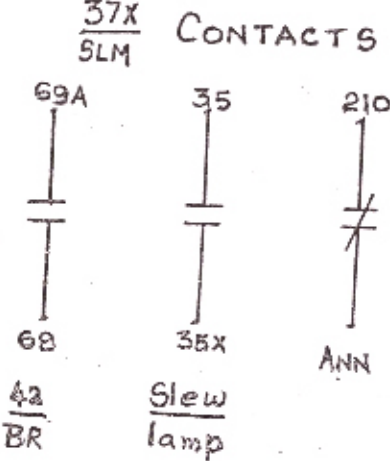
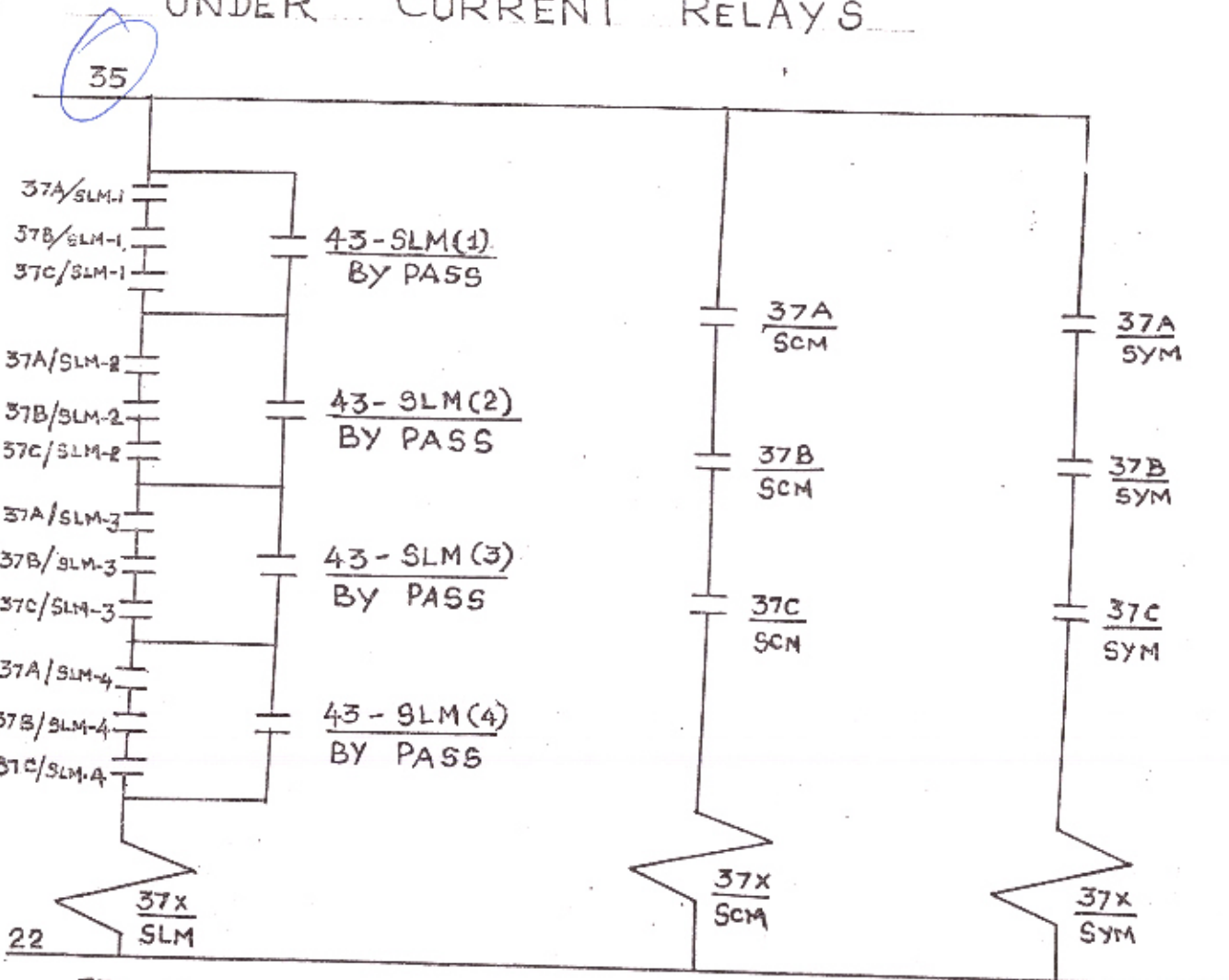
at N12 only  
changed  
on 8/9/2014  
22-11-85  
stops  
Slew  
West  
only



# THERMAL RELAYS



# UNDER CURRENT RELAYS

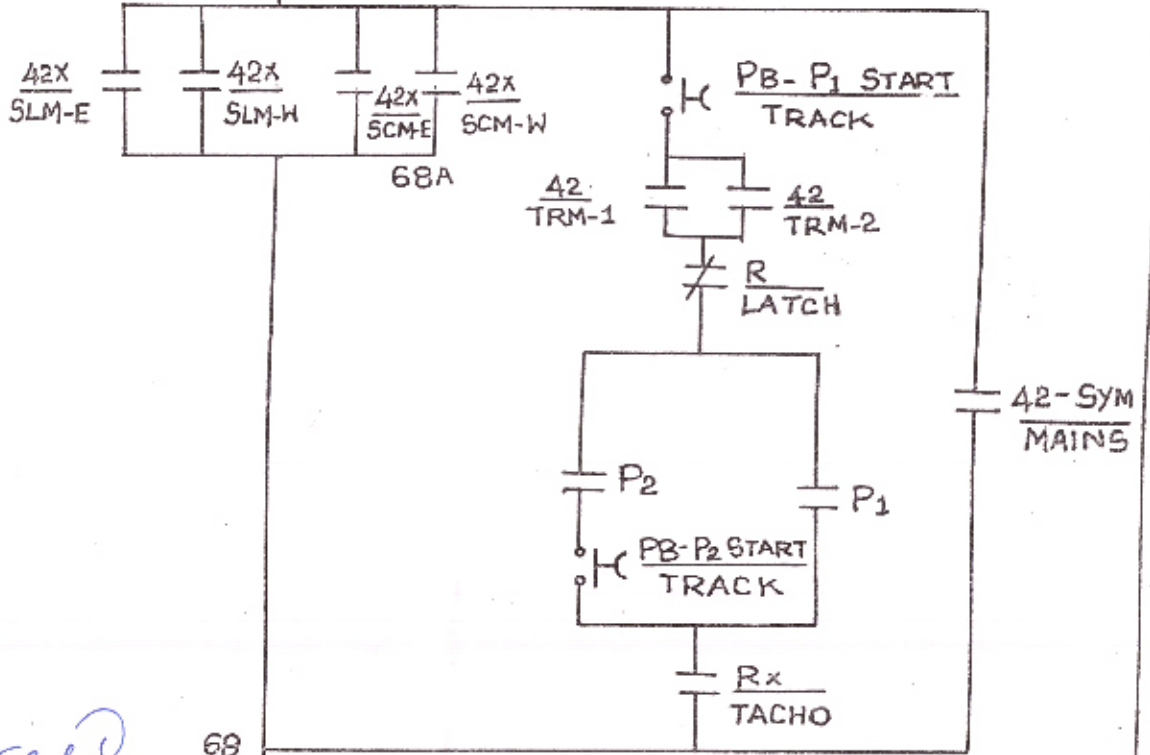


Senthil

0423 - 2244939

# BRAKES

35



Feed

68

MCC BACK SIDE

2  
BR

22

(2)

TDR coil

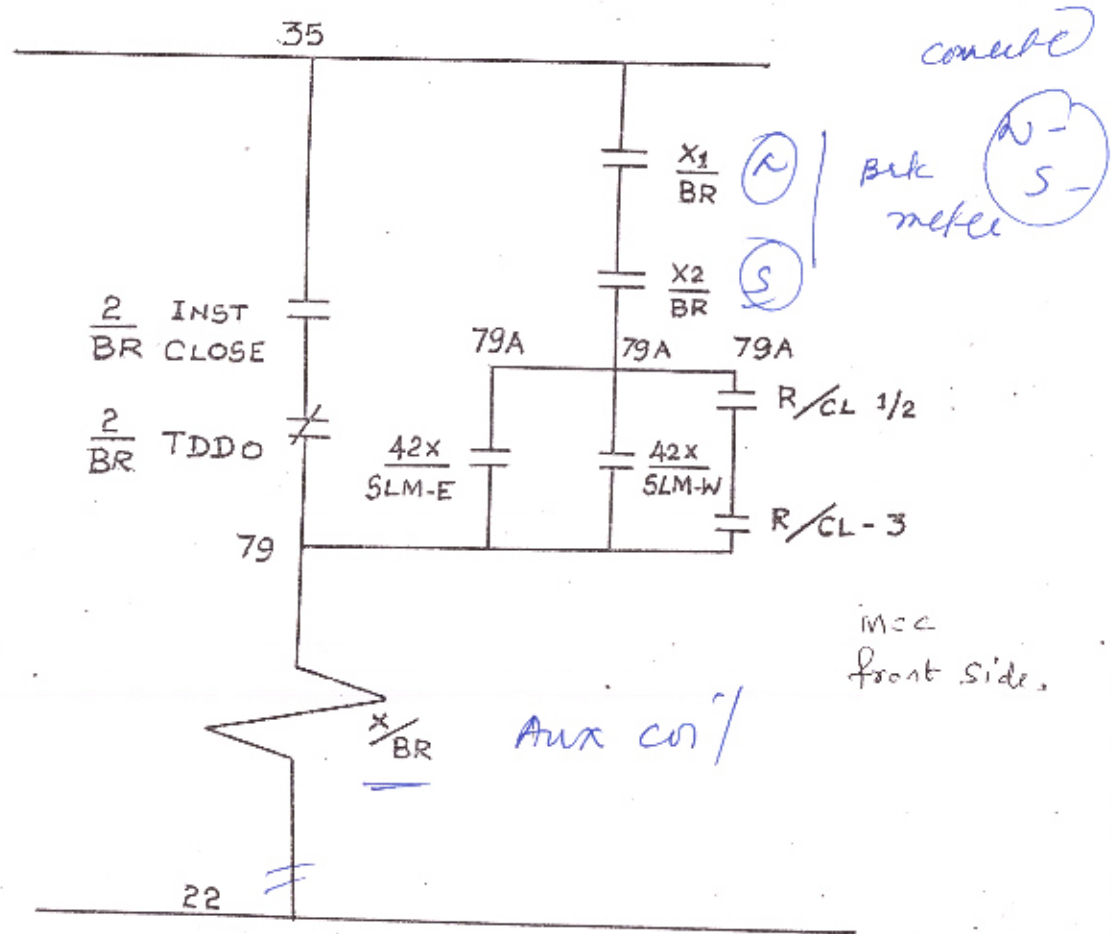
35

2  
BR INST CLOSE

2  
BR TDDO (700 m. Sec)

79

# BRAKES (CONTD) AUXILIARY BRAKE CONTACTOR

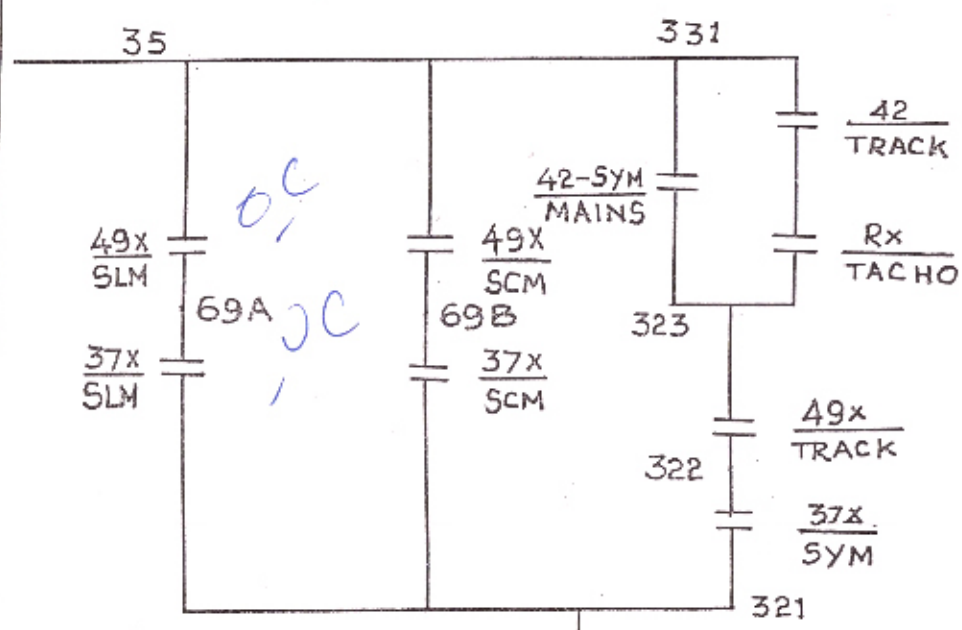


C14	C19	203	201	156A	204A	C23	C32	C28
C14	C20	202	200	354	204	C24	C31	C29
SCM cct	SLM cct(1)	TRACK cct				SLM(2) cct	SLM(4) cct	SLM(3) cct





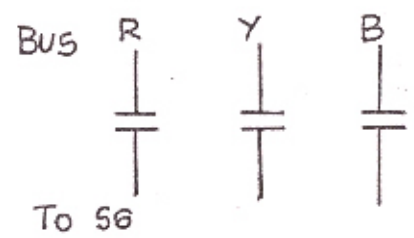
# BRAKES (contd) MAIN BRAKE POWER CONTACTOR



*OC*  
*OC*

*Brk main*

## BRAKES POWER



- 214
- 61
- 52
- 216
- 205
- 211 clutch Current failure Ann
- 61A SCM Hold on
- 48A SLM Hold on
- 209 BRAKE Failure Ann
- 204A Motor Trip Ann

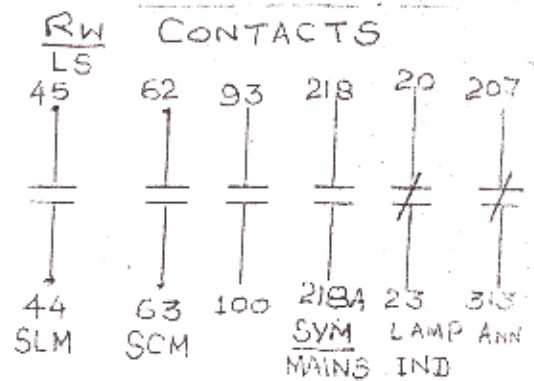
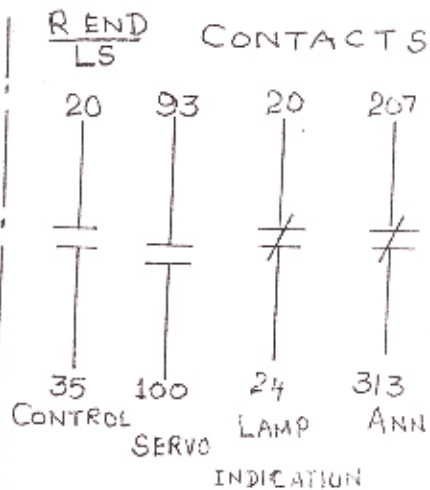
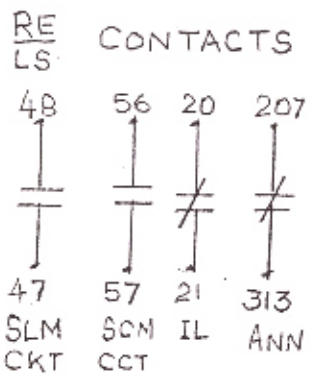
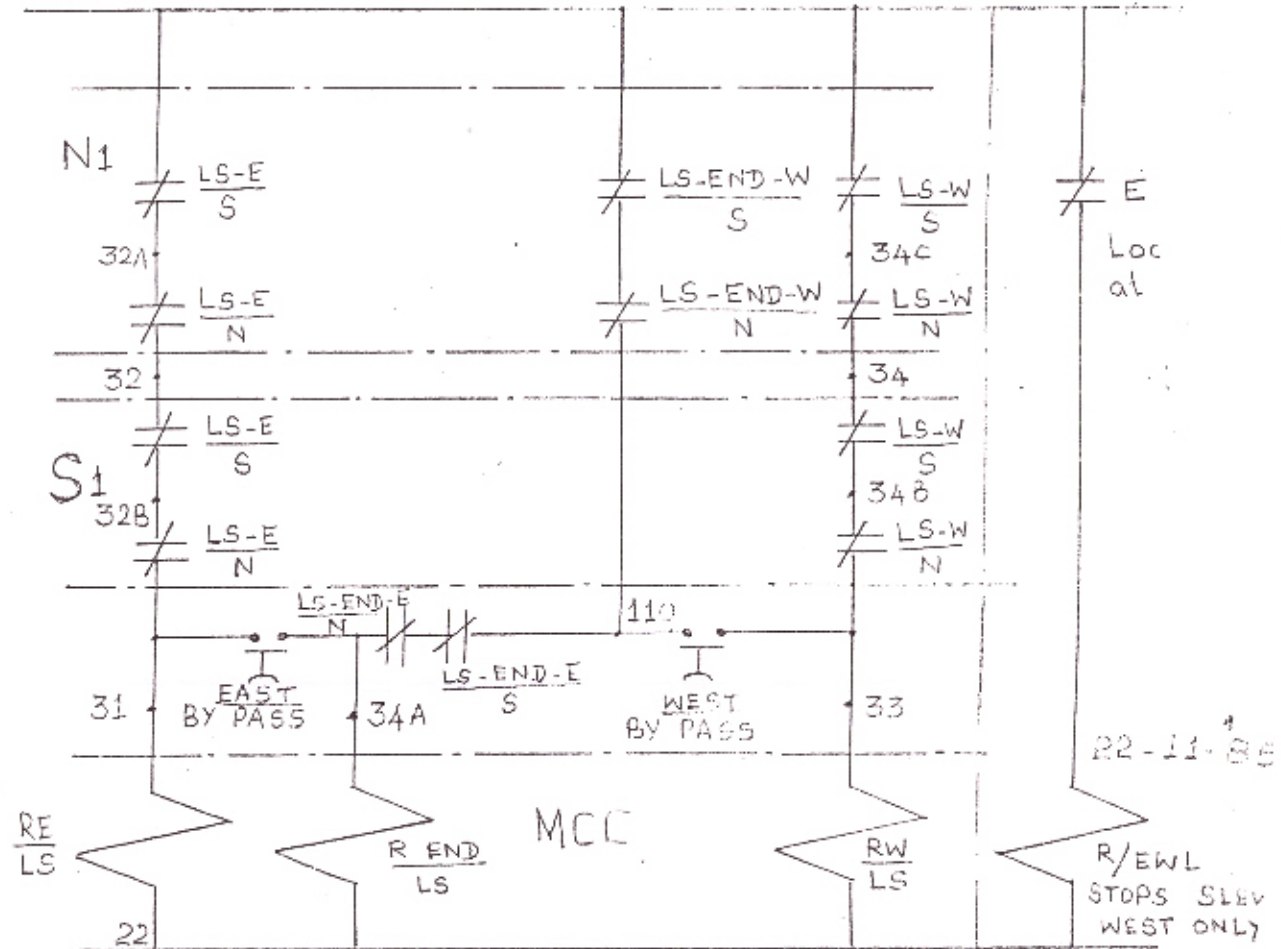
22

69

$\frac{42}{BR}$

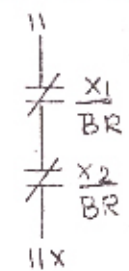
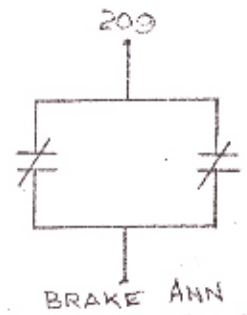
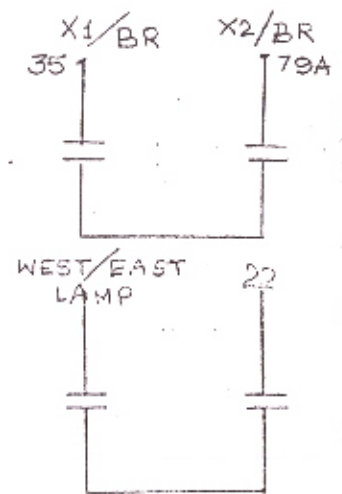
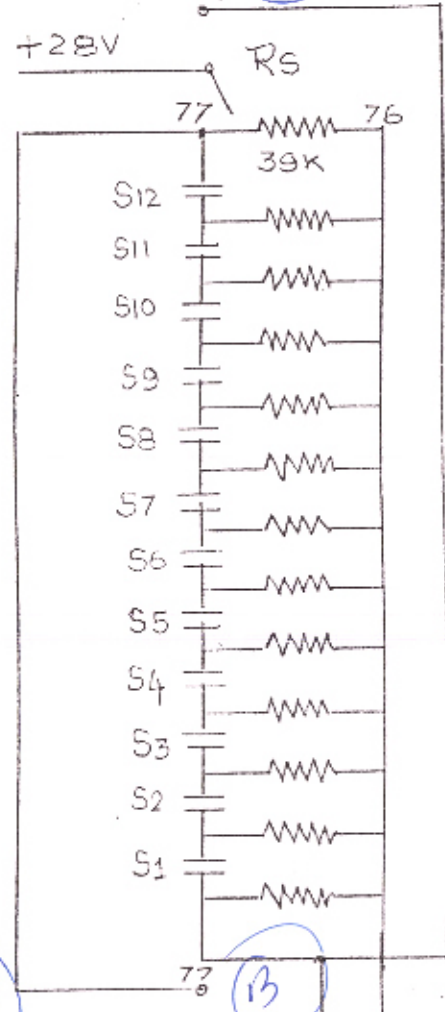
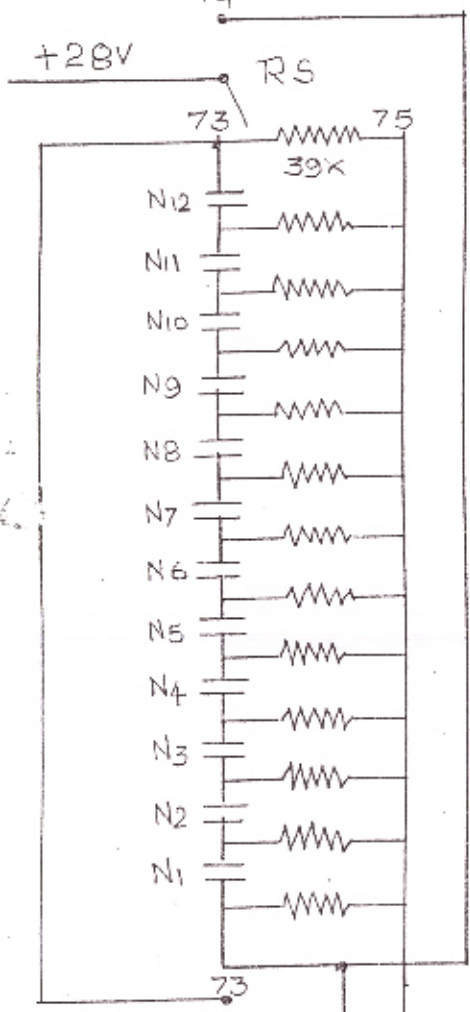
# LIMIT SWITCHES

20



2-way switch

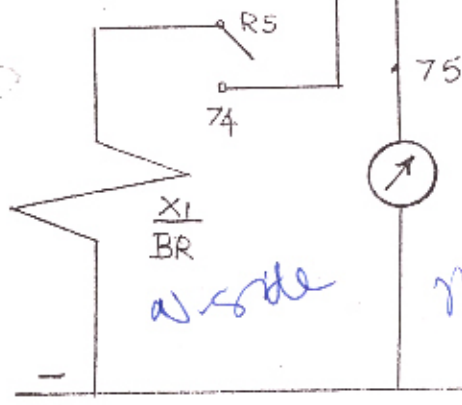
2-way switch



TACHO BYPASS

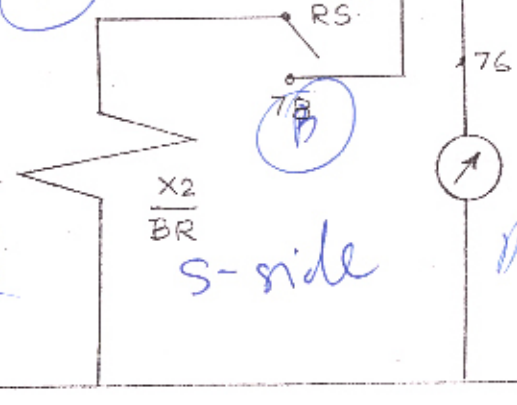
A

B



W side

mel



S-side

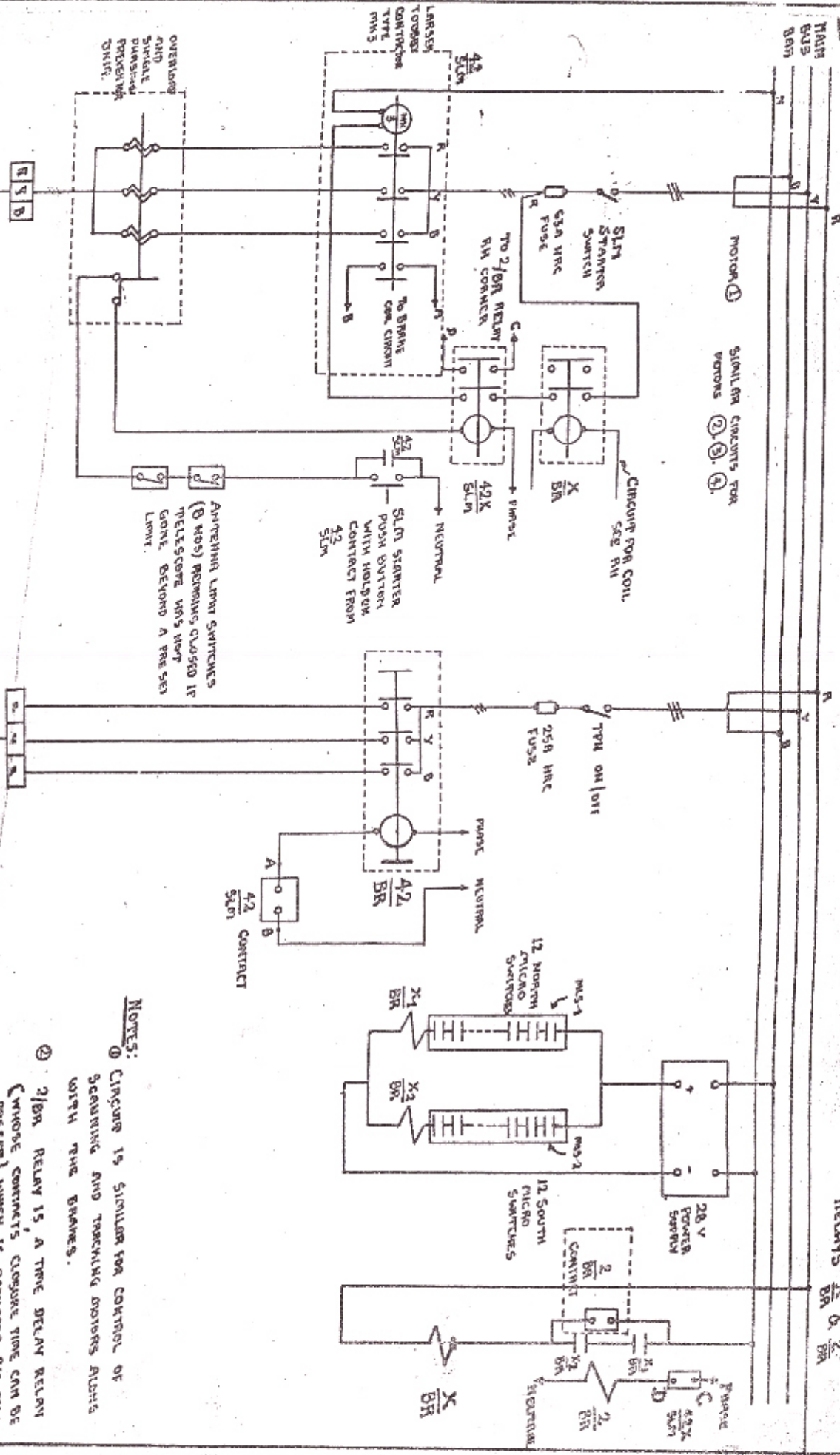
rebe

Control room

4 STEERING MOTORS

24 BRAKES

Relays X BR & 2/BR



TO STEERING MOTOR NO. 1  
 TERM. NO. 1  
 240 V. AC 50 Hz. 1/2 H. MOTORS 2, 3, 4.  
 NOTE: ALL 4 MOTORS ARE 4-7-10/15  
 COUPLED TOGETHER. 75% IN  
 GEAR BOXES AND 5/29 GEARS  
 LEAVE DRIVE SHAFT

TO BRAKE COILS  
 240, 440V SINGLE PHASE  
 BRAKES IN GROUPS OF 6.

NOTES:

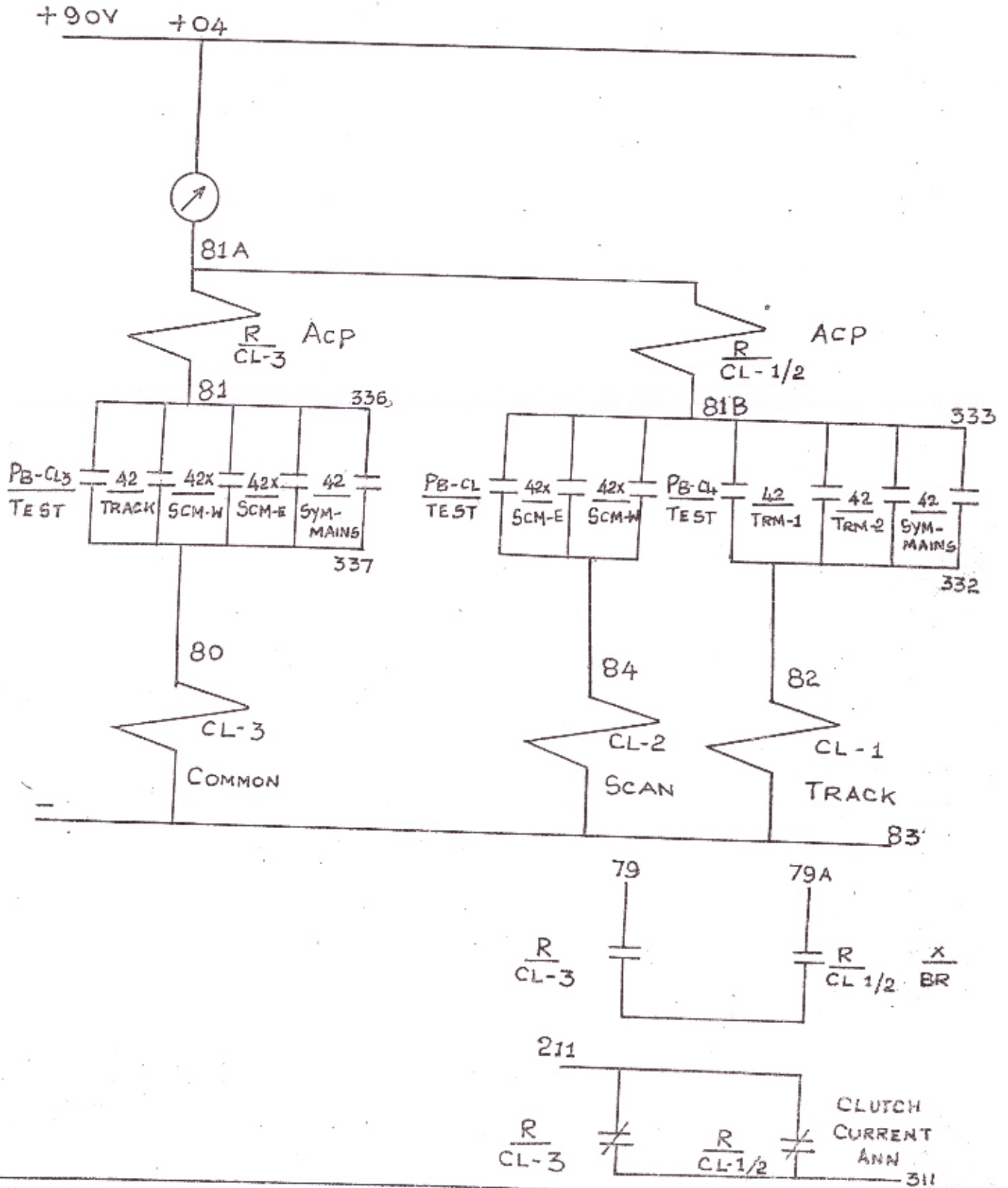
- ① CIRCUIT IS SIMILAR FOR CONTROL OF SCUBING AND TANKING MOTORS ALTHO WITH THE BRAKES.
- ② 2/BR RELAY IS A TIME DELAY RELAY (WHOSE CONTACTS CLOSE TIME CAN BE PRESET) WHICH IS ACTUATED BY ONE OF THE 42X CONTACTS.  
 THE PRE SET TIME SHOULD BE LESS THAN 150 m. SEC.

ABBREVIATED ELECTRICAL CIRCUIT FOR CONTROLLING BRAKES & STEERING MOTORS OF DOT RADIO TELESCOPE

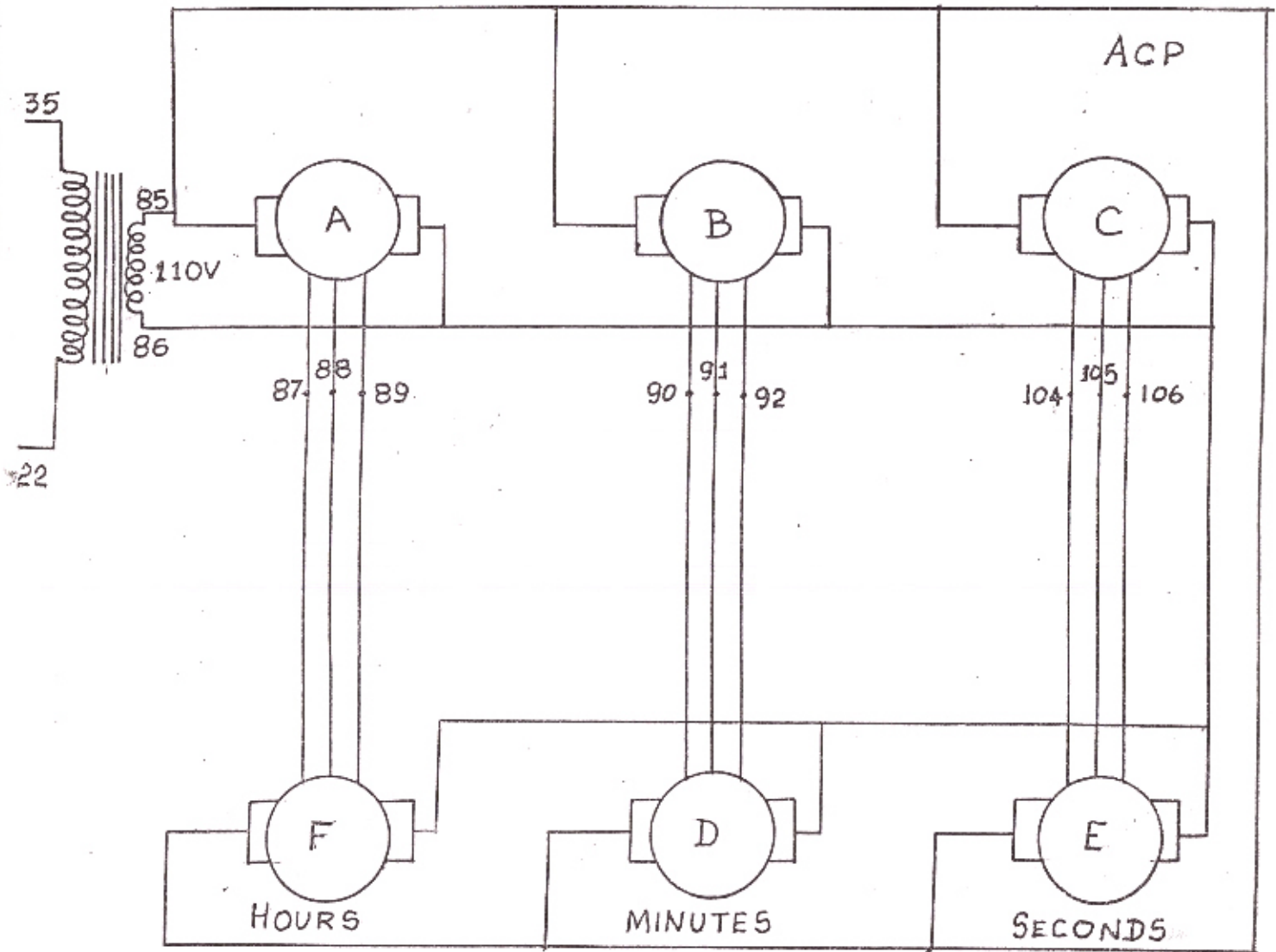
DRG. NO. X8C1015B

DRAWN: A. H. A.

# CLUTCHES

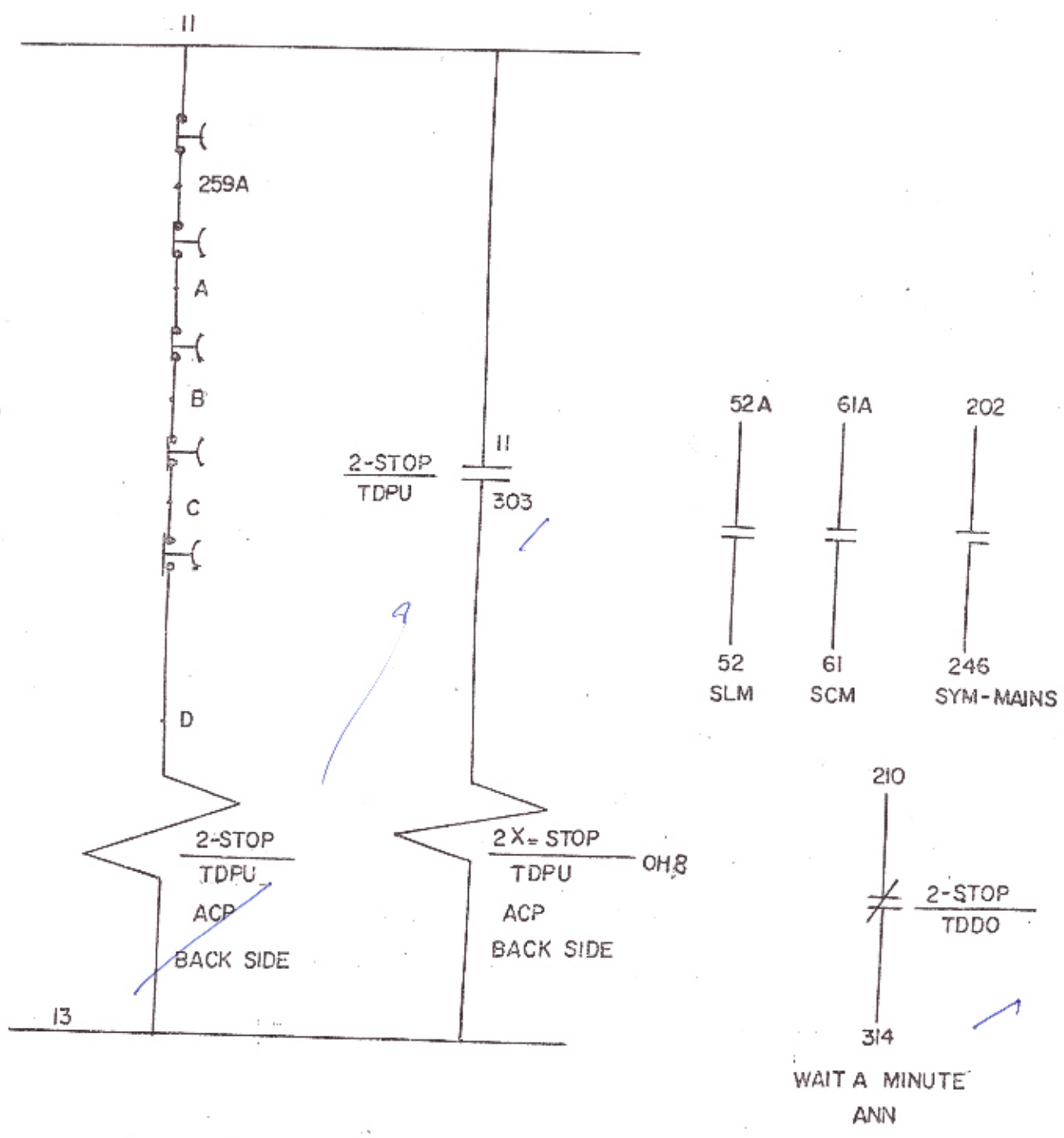


# ANTENNA POSITION INDICATOR

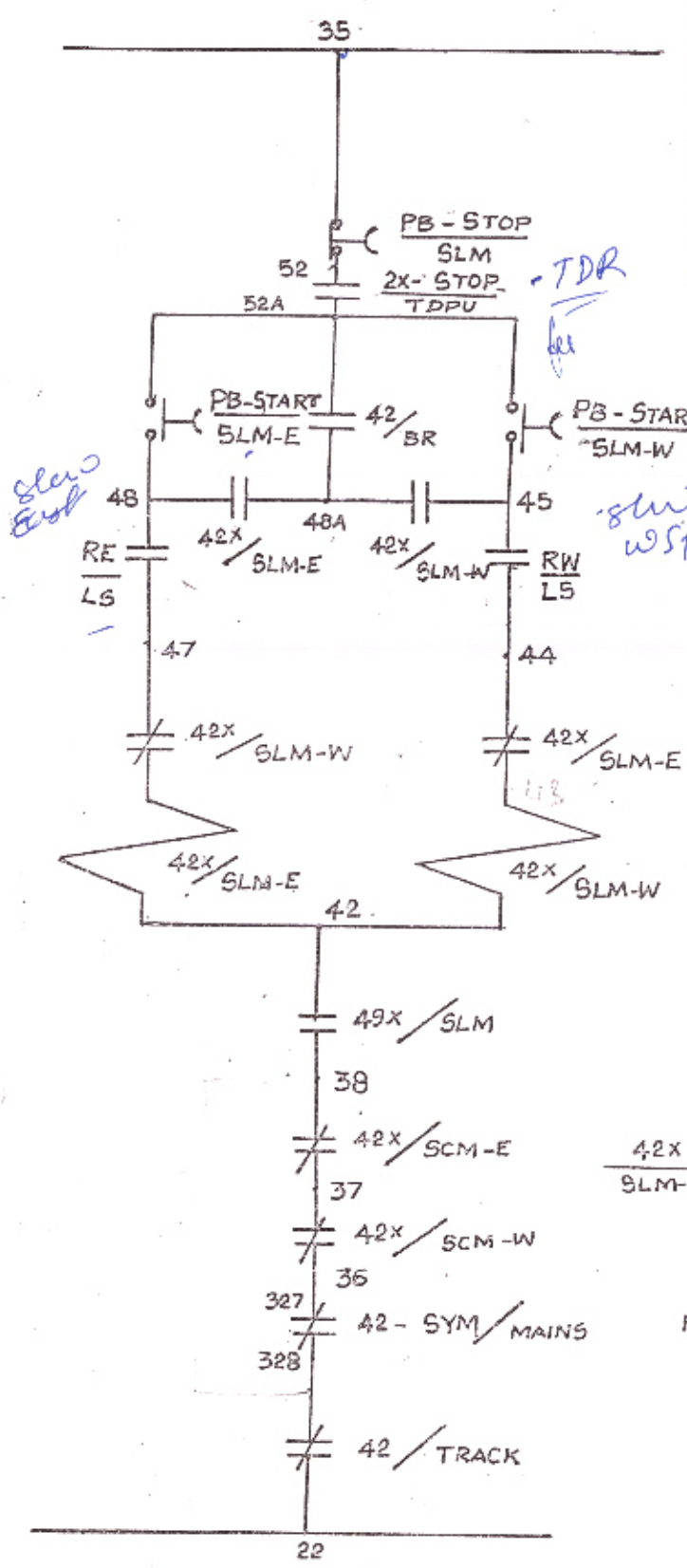
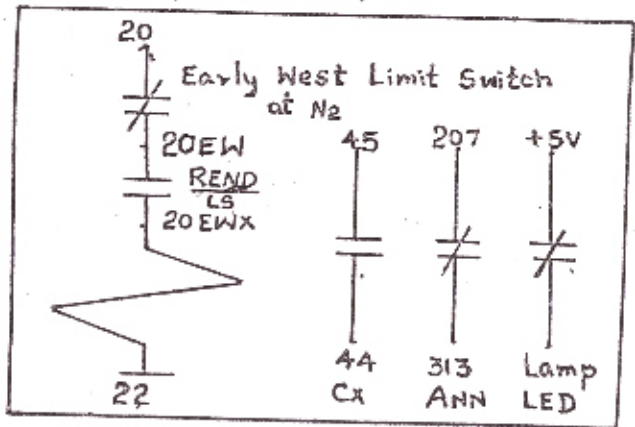


POSITION SYNCHROS AT N1

# PROTECTION TO TELESCOPE DURING OPERATION



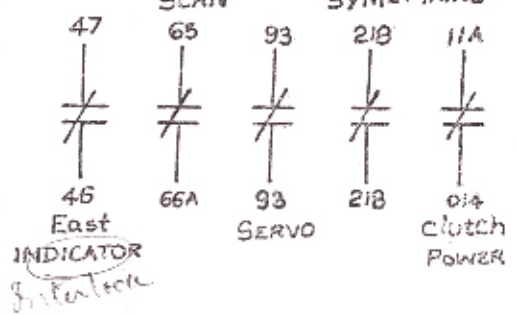
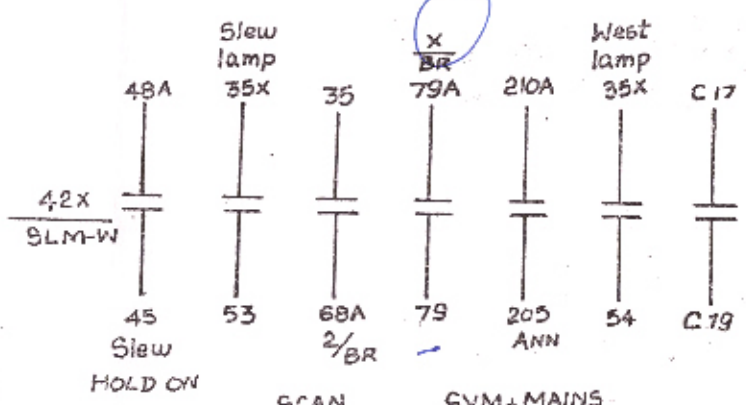
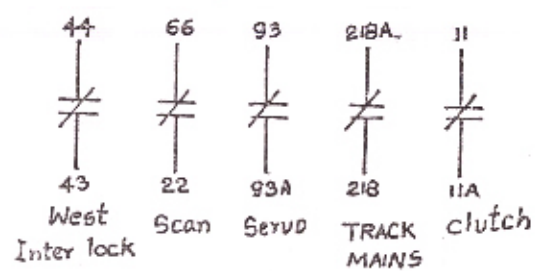
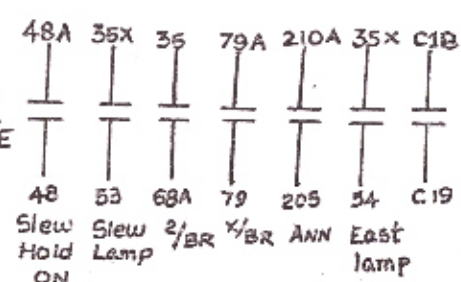
# SLEWING CONTROL CIRCUIT AUXILIARY



*Slew East*

*TDR*

*slew west*

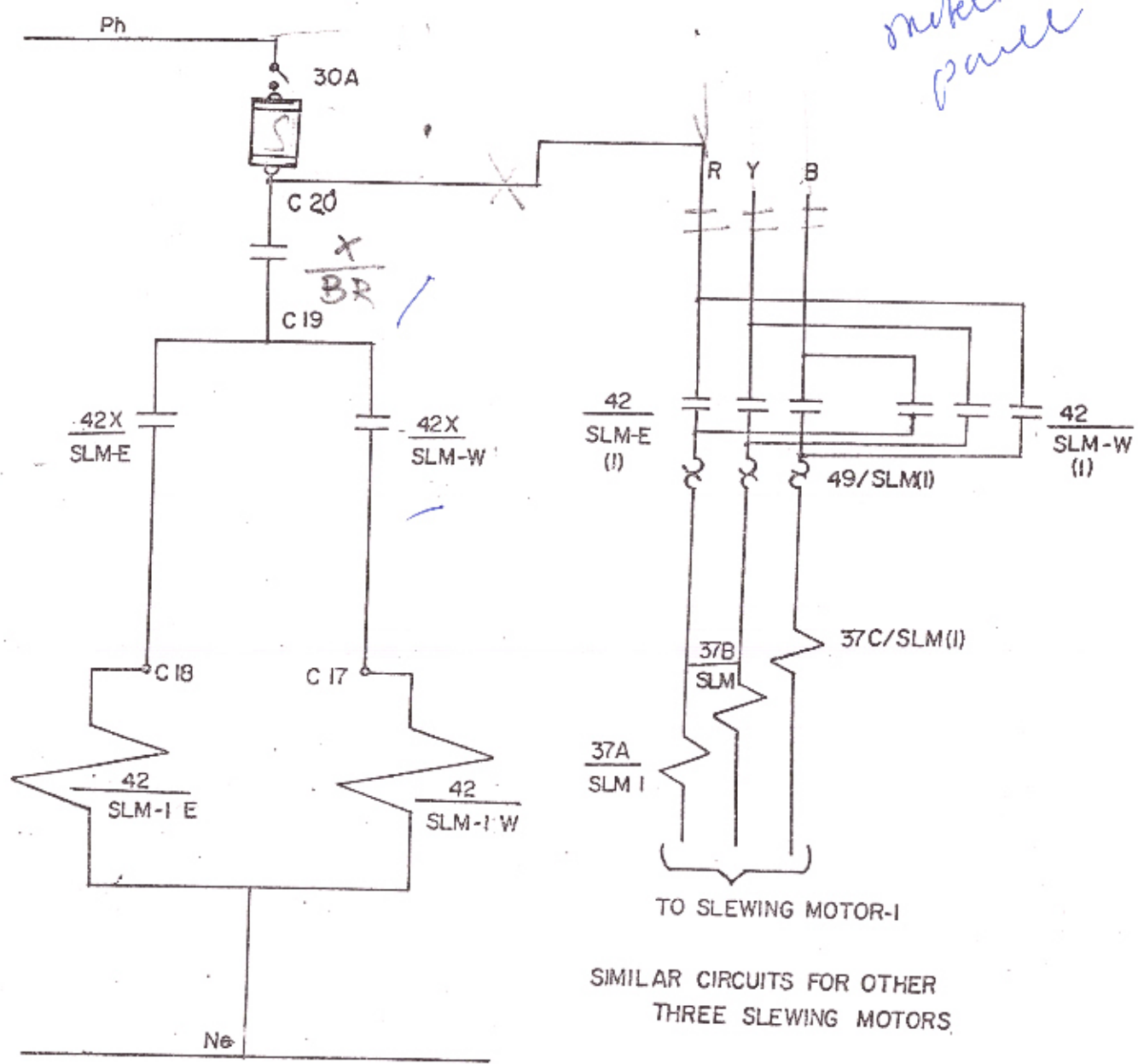


*East INDICATOR*

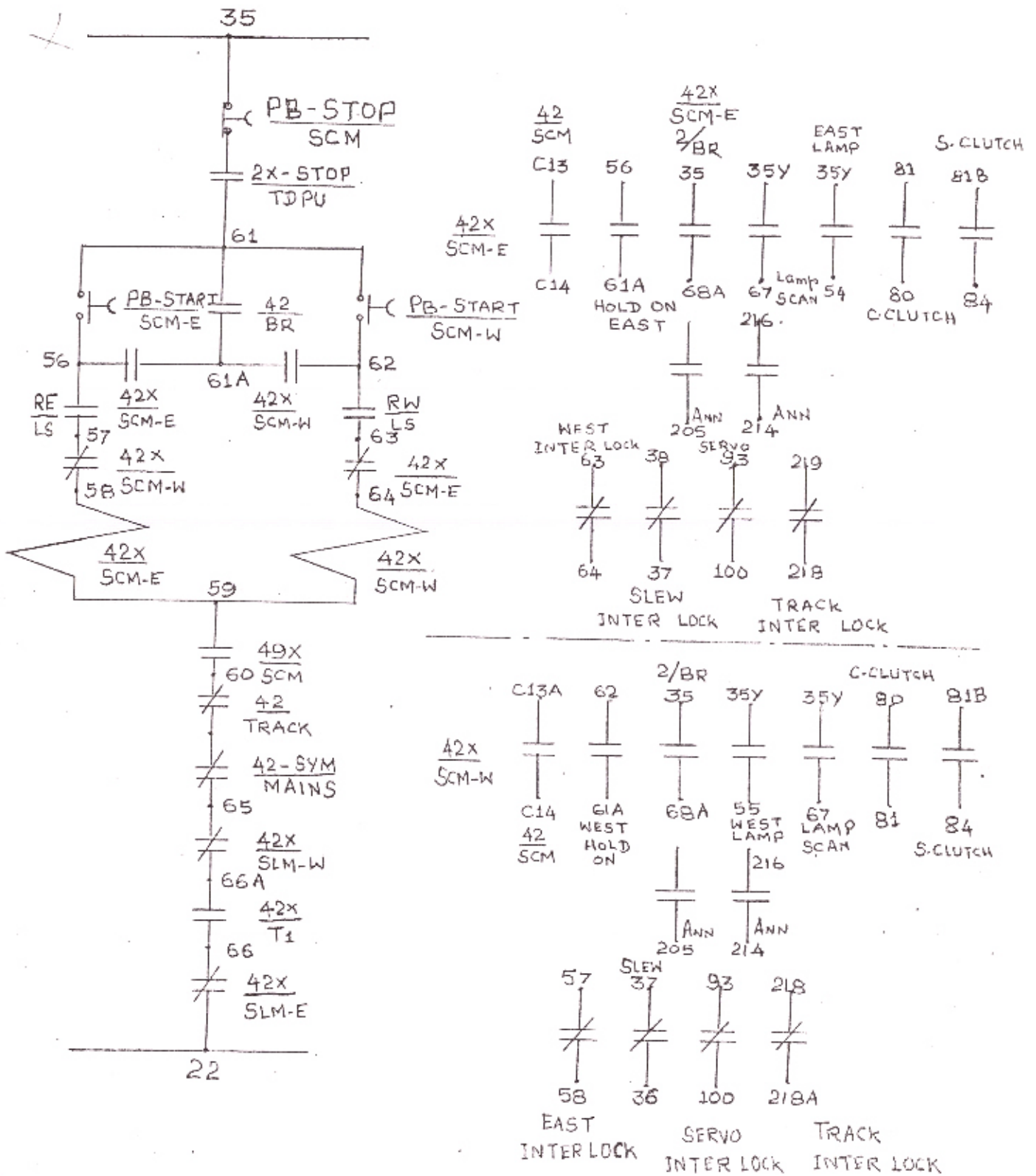


# MAIN MOTOR POWER CONTACTOR

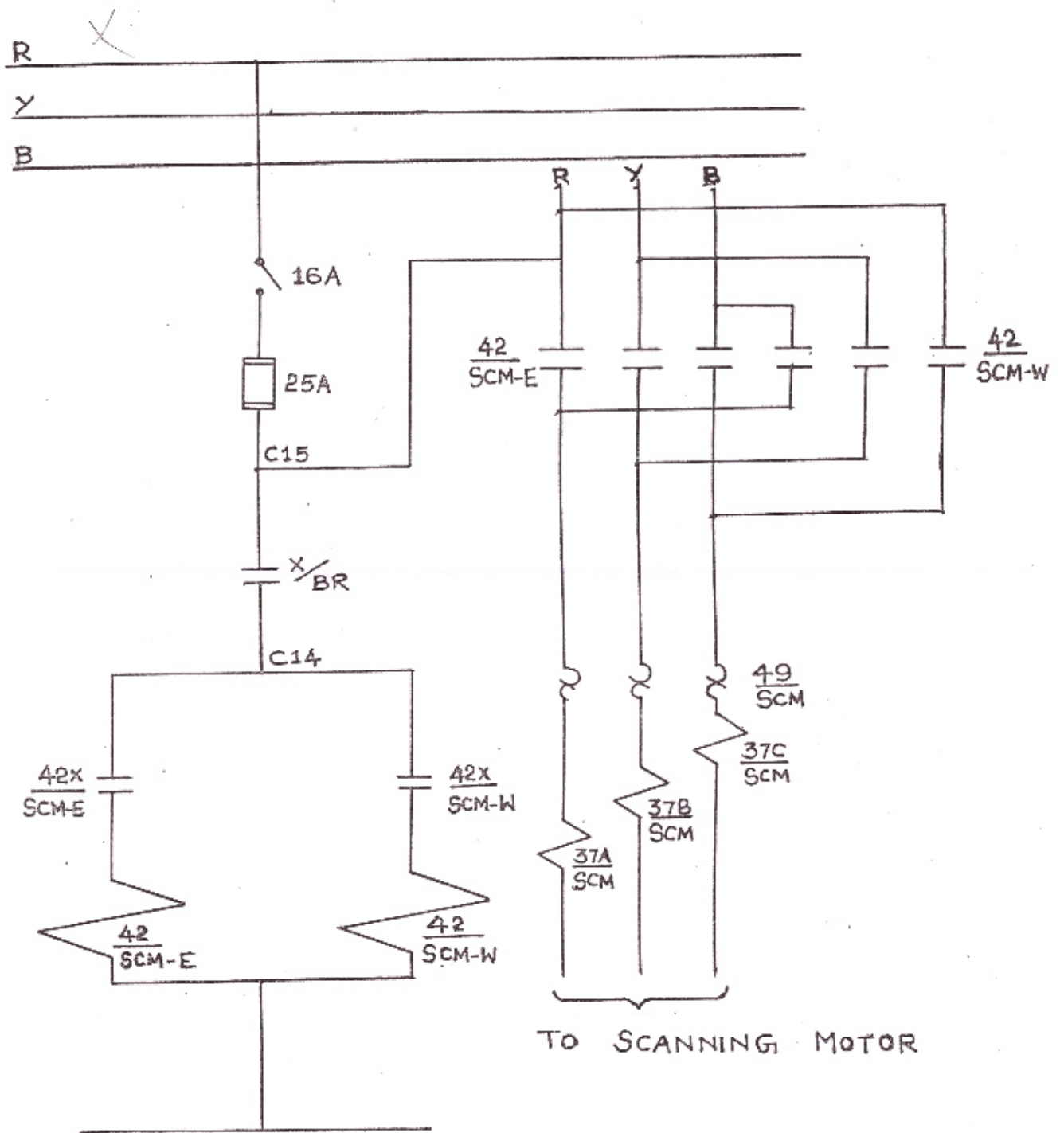
*make  
panel*



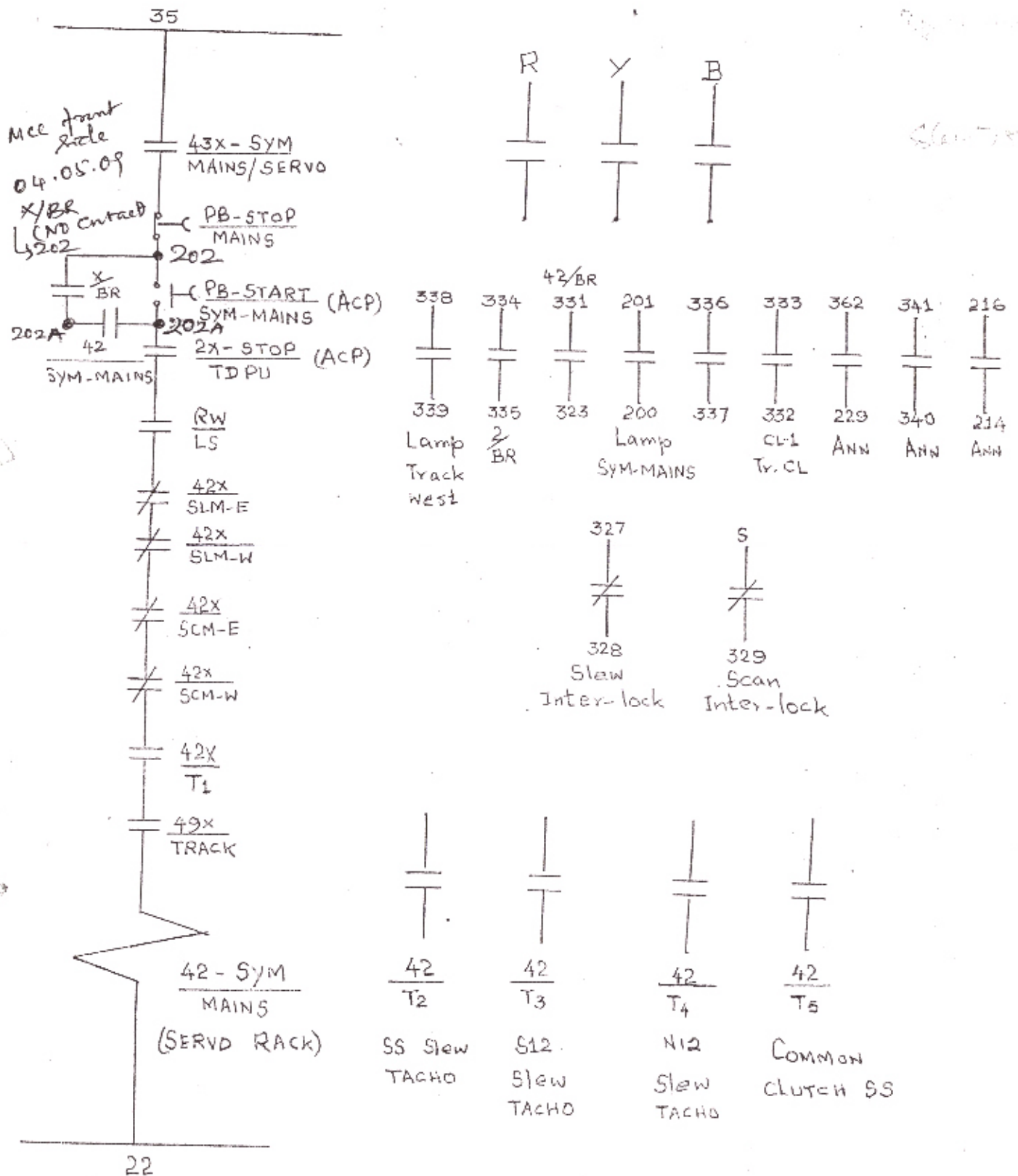
# SCANNING CONTROL CIRCUIT (AUXILIARY CIRCUIT)



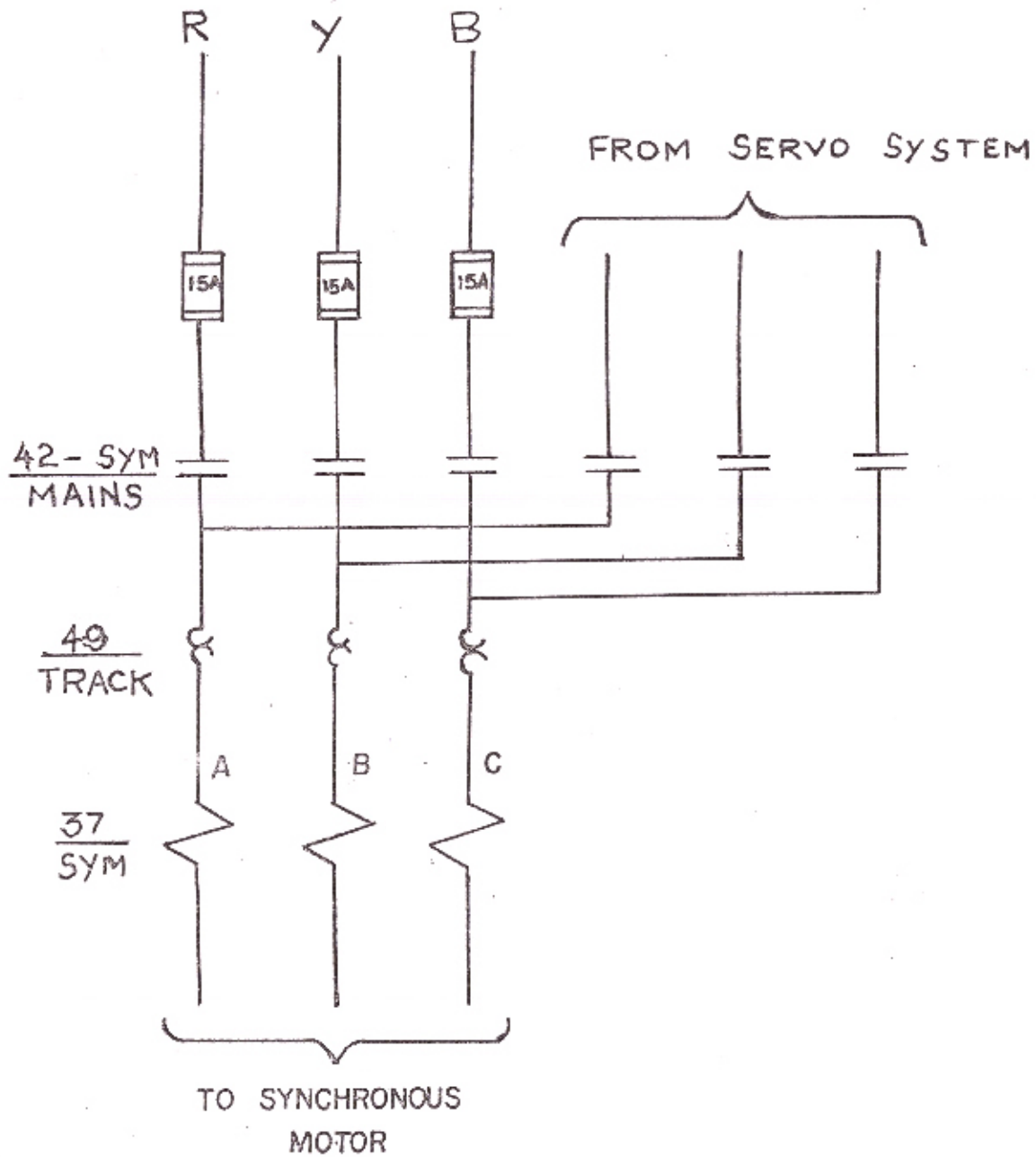
# MAIN CONTACTOR - SCANNING MOTOR CIRCUIT



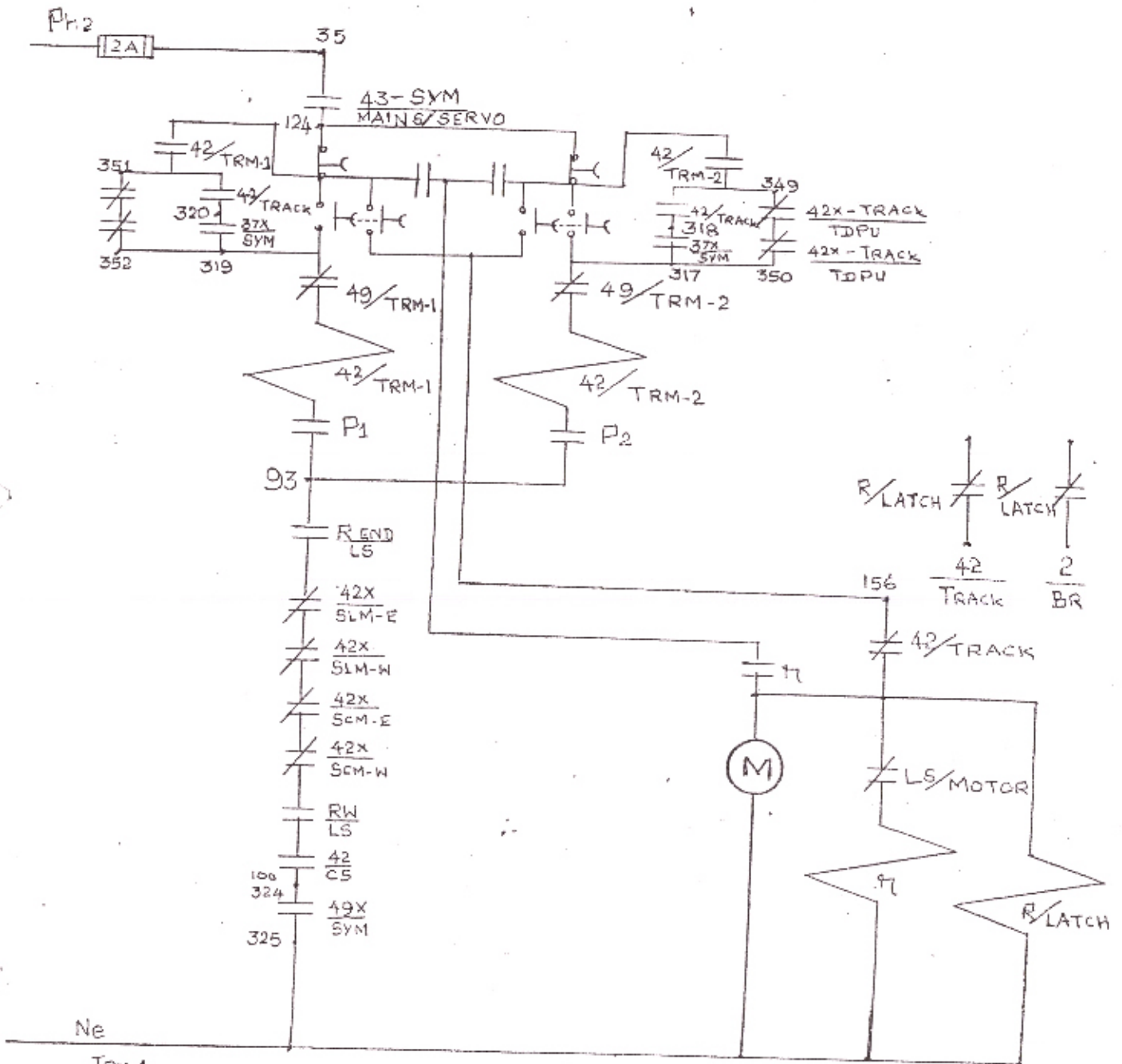
# TRACKING MOTOR CIRCUIT MAINS



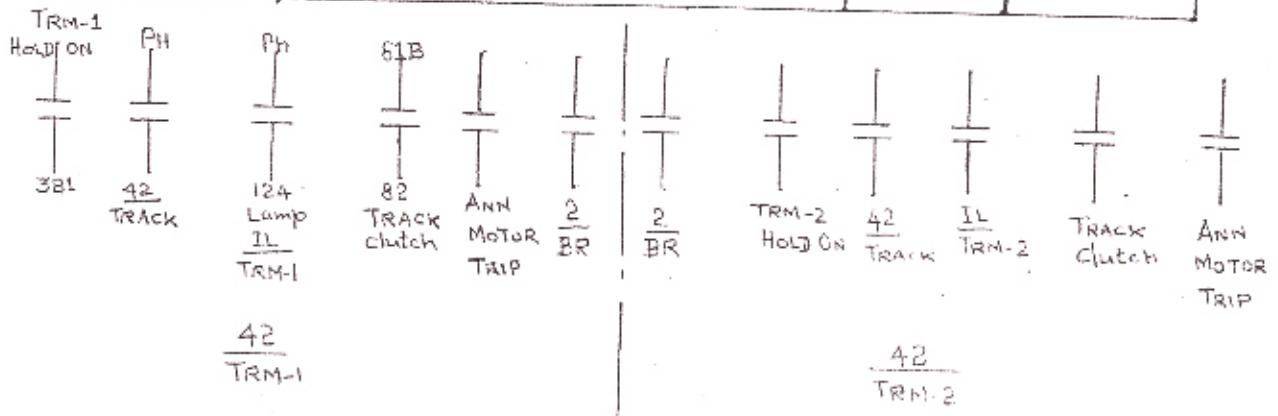
# POWER CIRCUIT



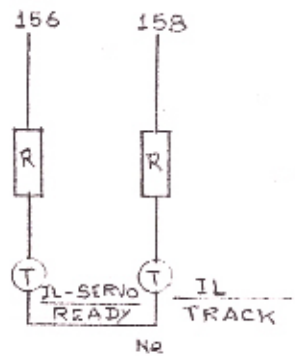
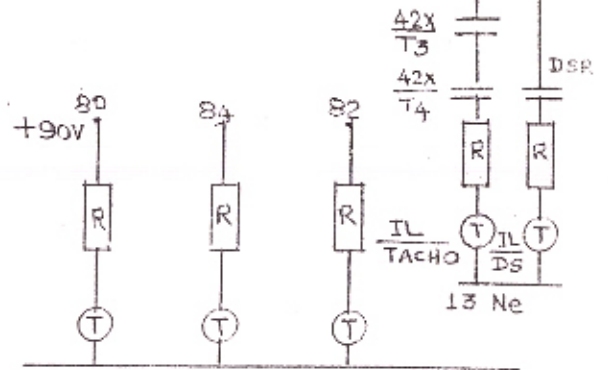
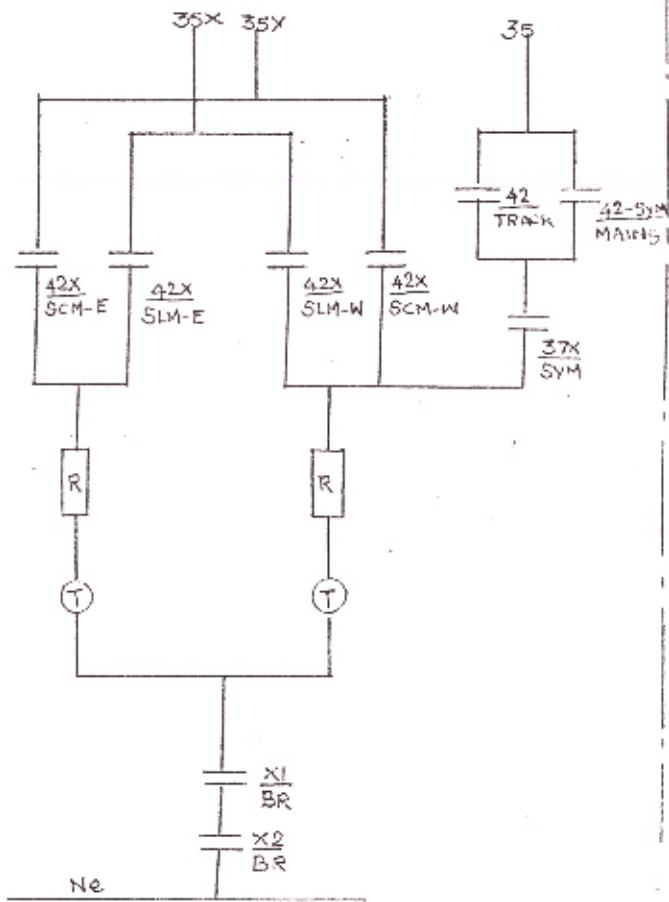
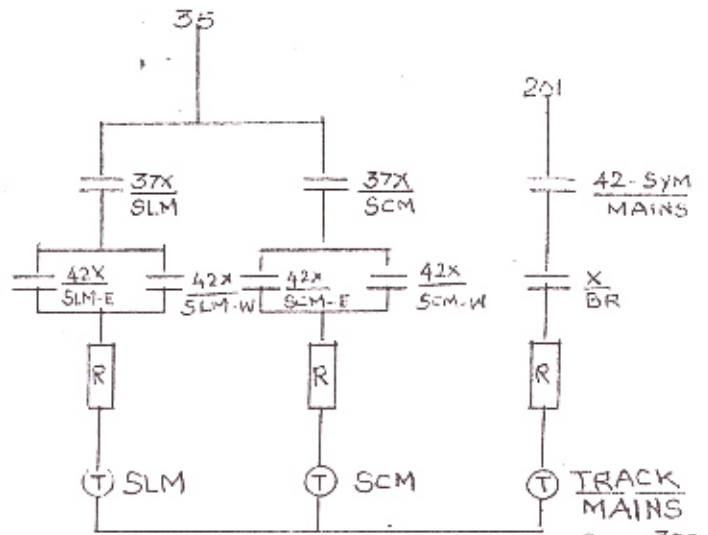
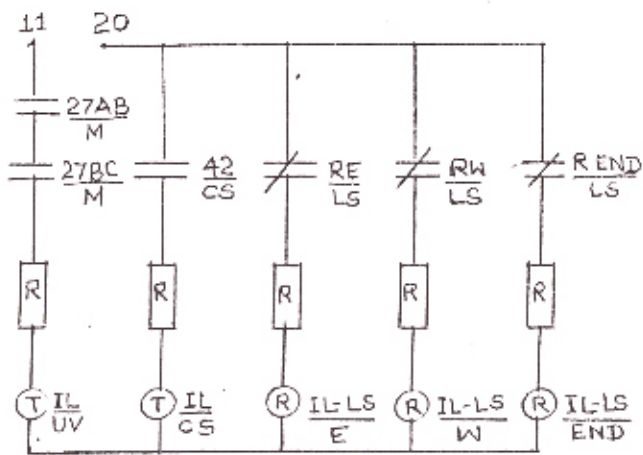
# TRACKING MOTOR PANEL



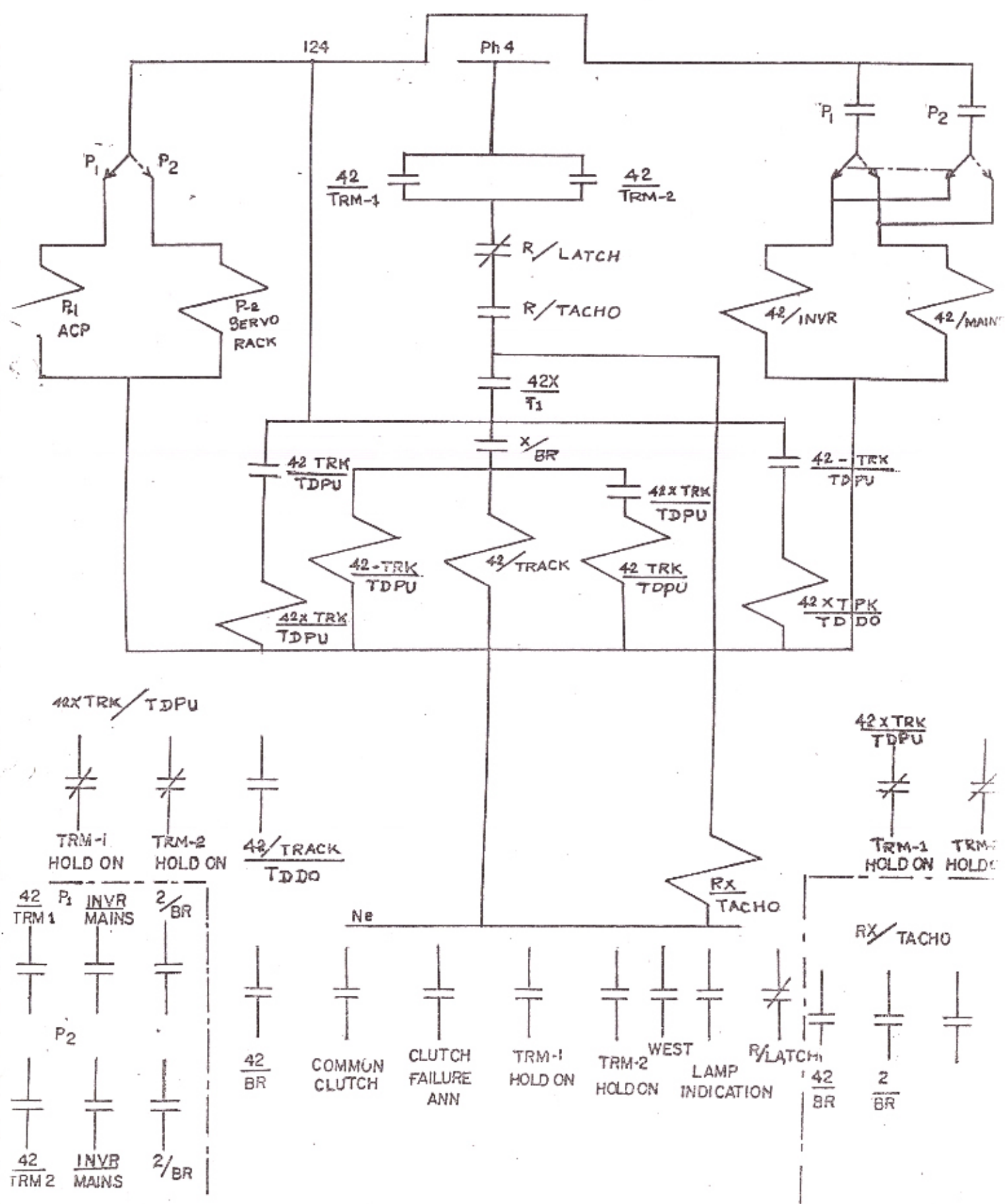
Ne



# INDICATION LAMPS

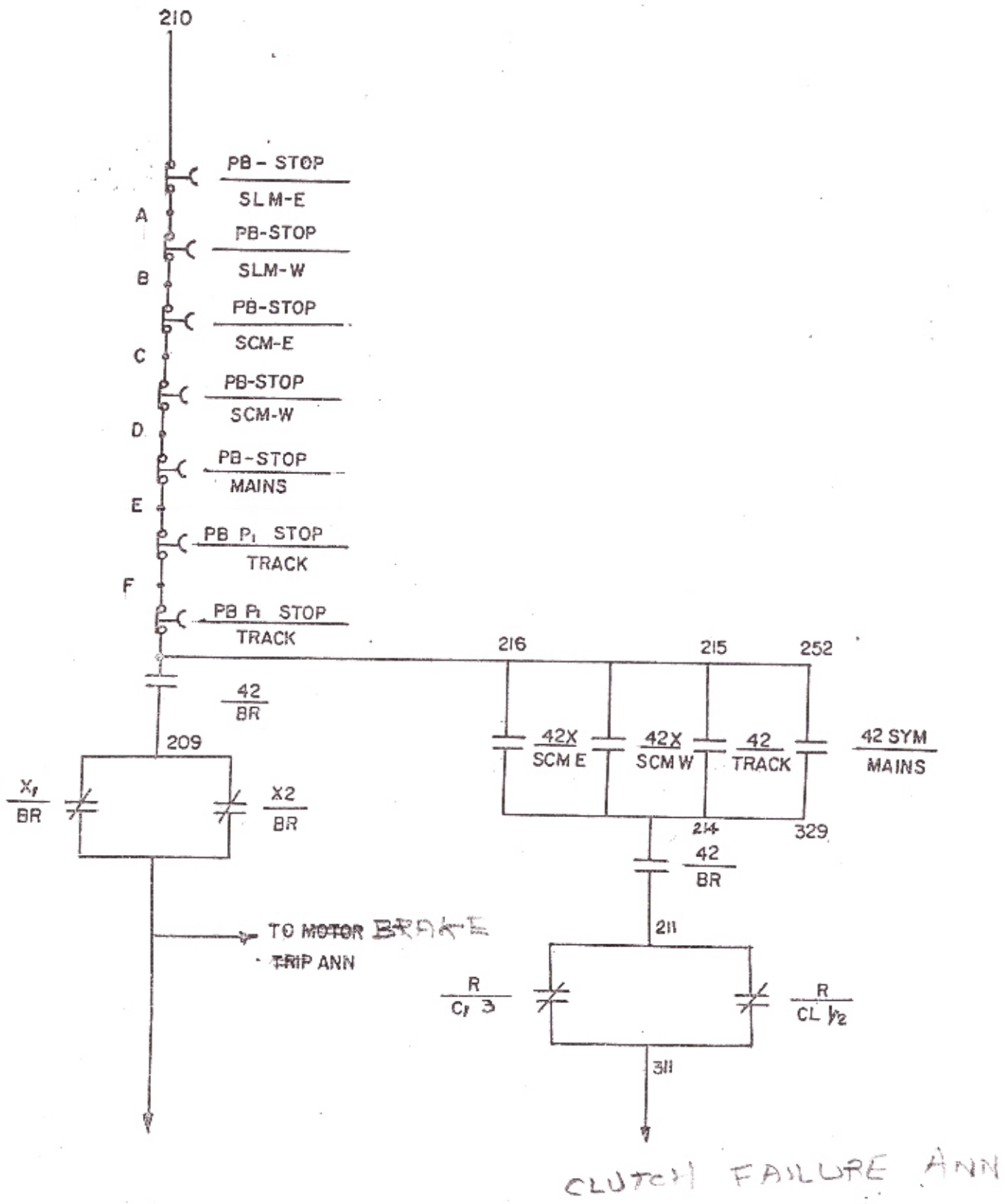


# TRACK (SERVO) SYSTEM

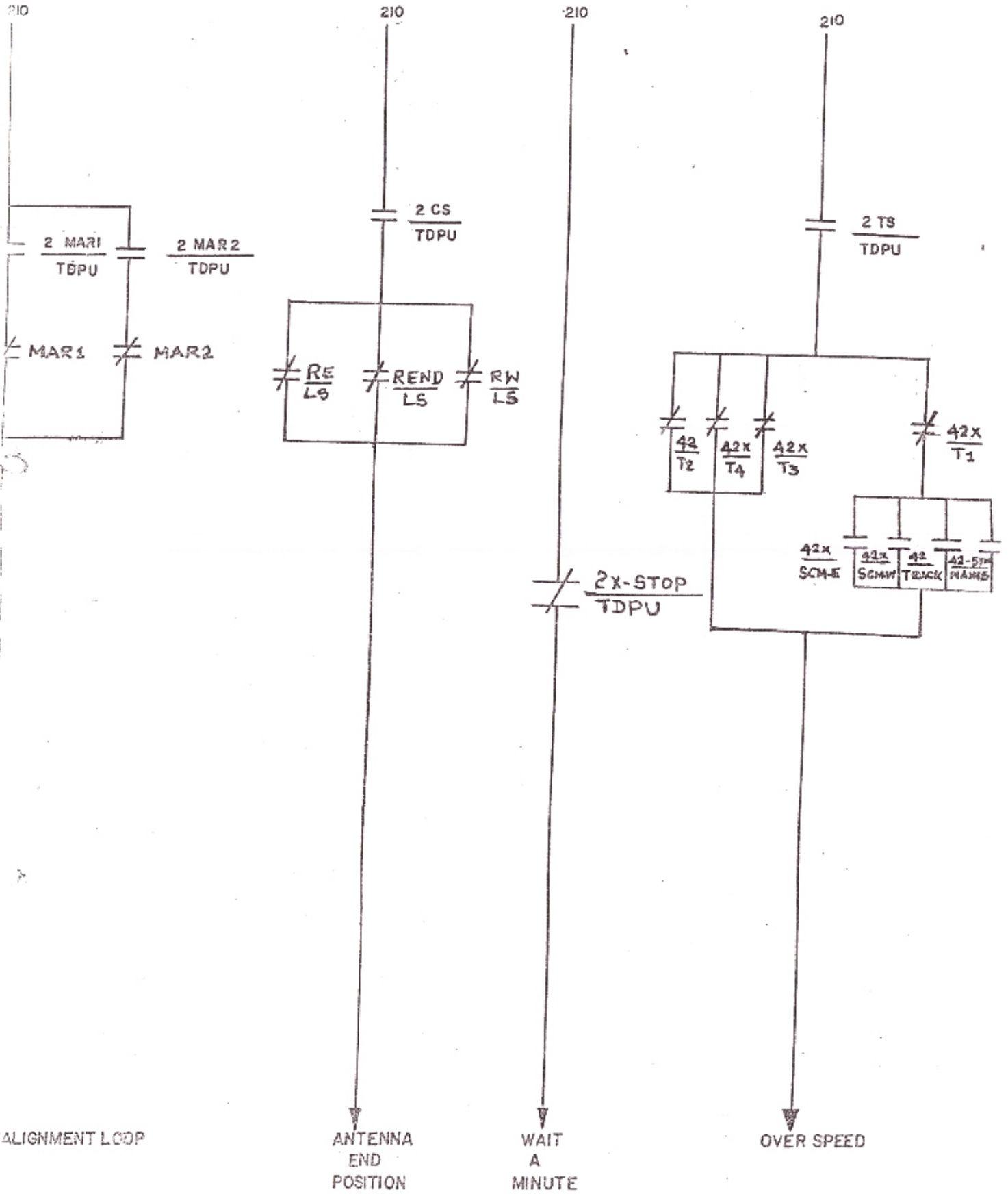




# ANNUNCIATION CIRCUITS

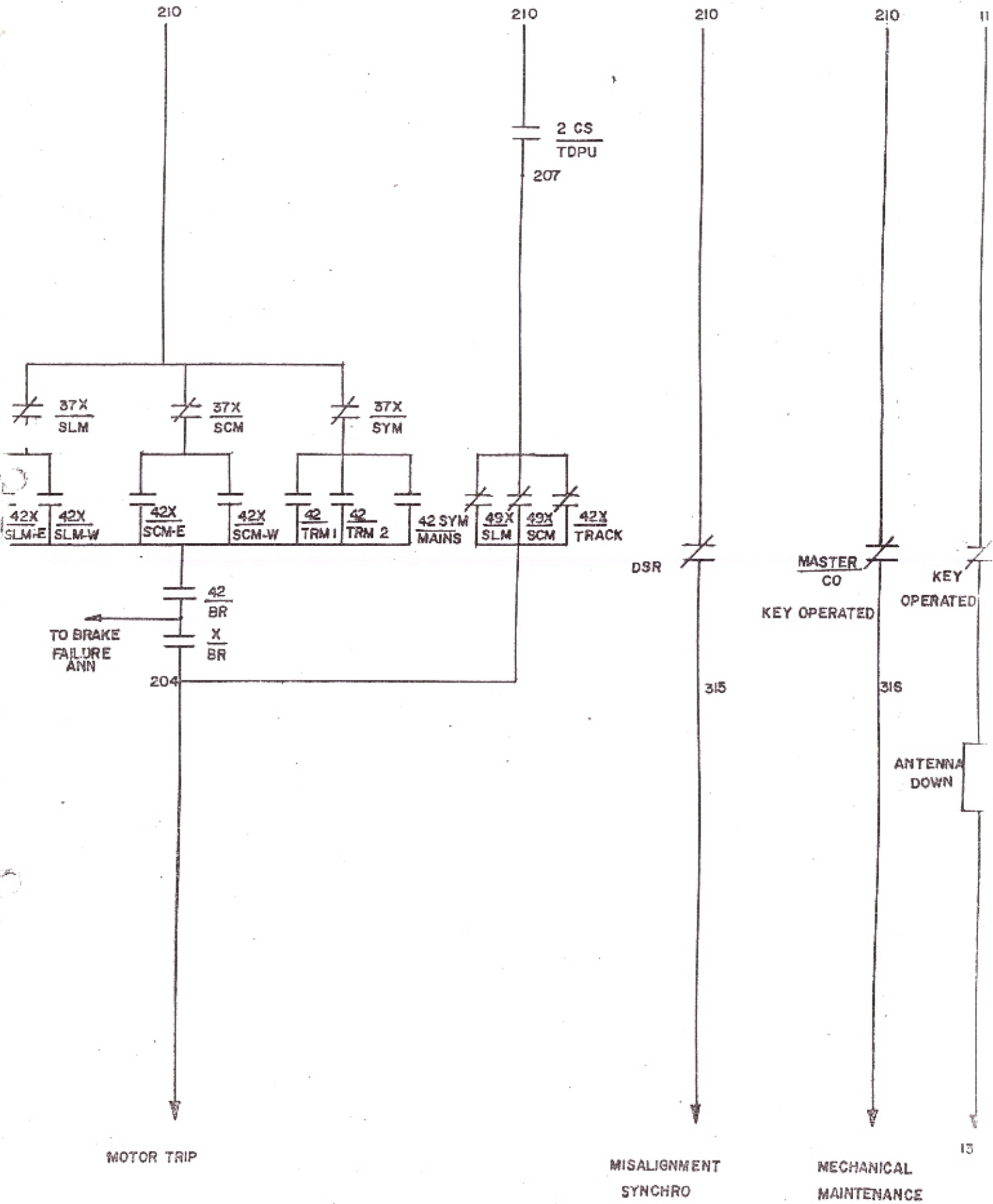


# ANNUNCIATION CIRCUITS CONTD



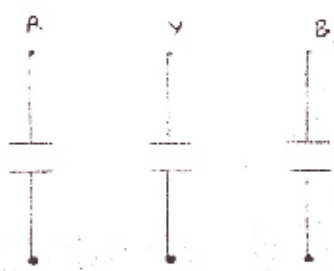
# ANNUNCIATION CIRCUITS CONTD

35

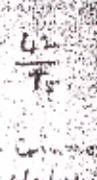
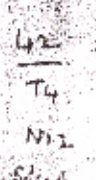
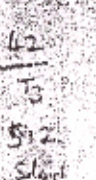
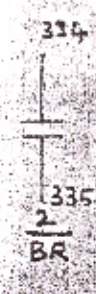
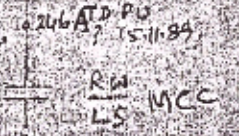
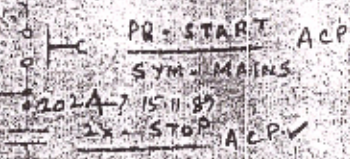
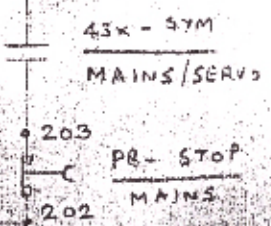


# LOCKING MOTOR CIRCUIT (MAINS)

35



Key actuator (ACP)



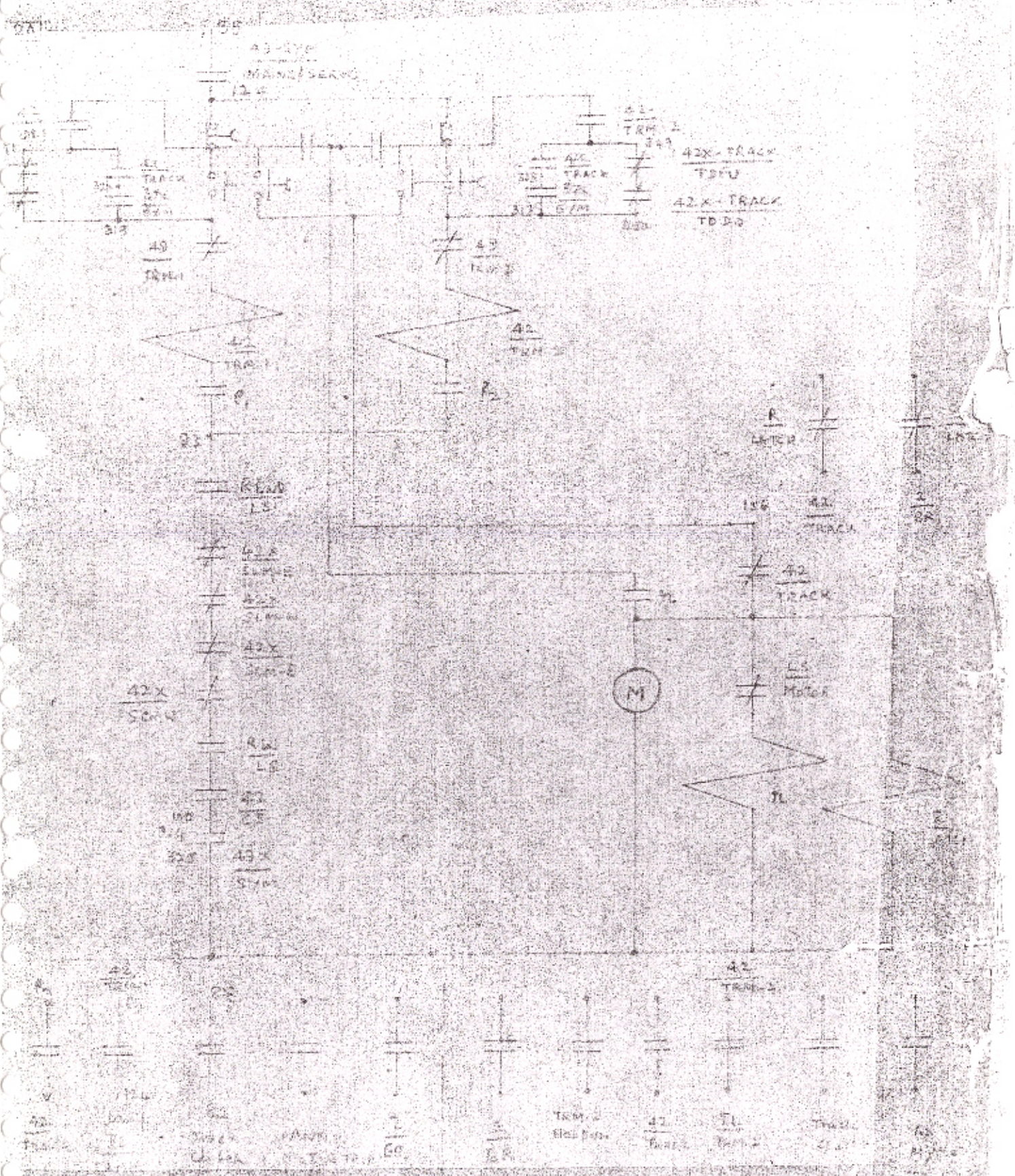
goes to  
MA 2 C/O  
346 A 2 C/O  
Terminal  
246 A

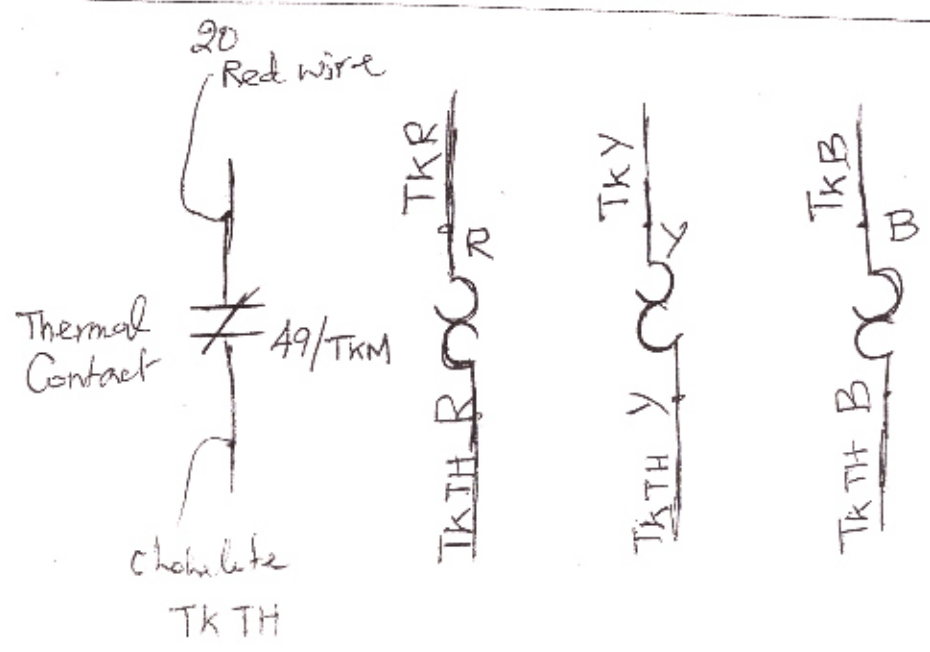
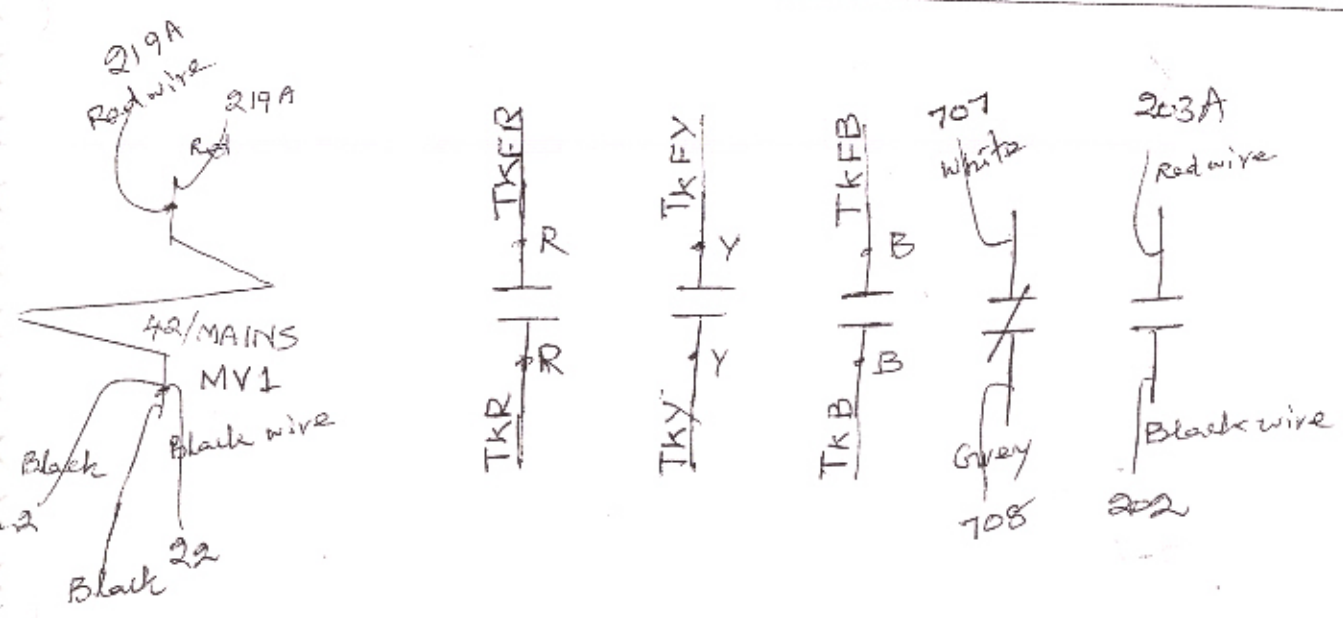
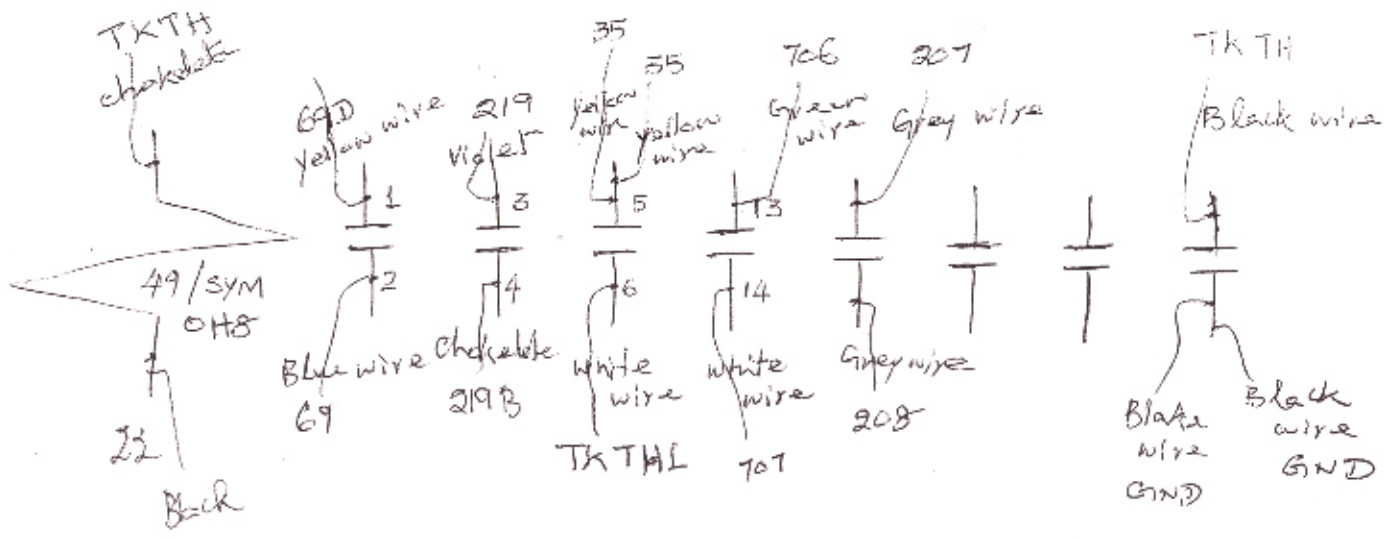
2 MCC Bottom  
Panel

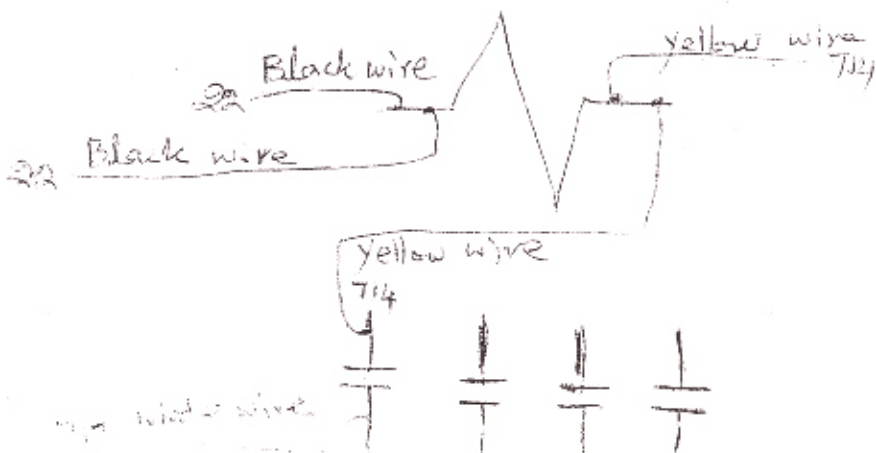
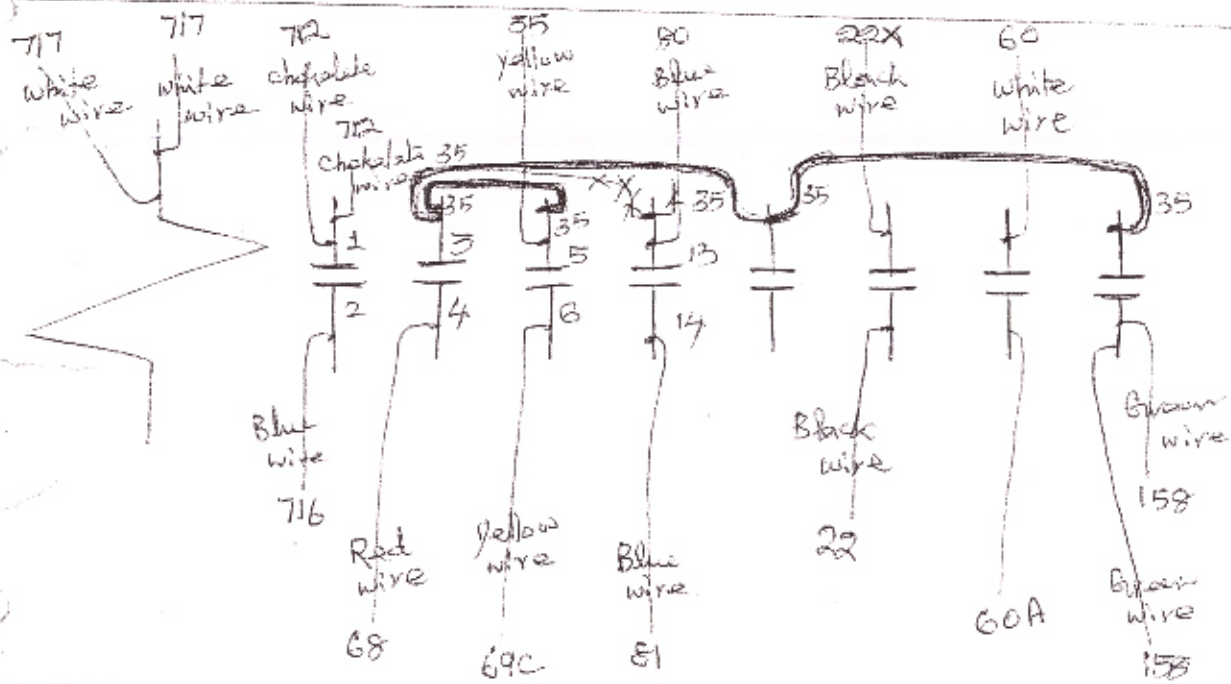
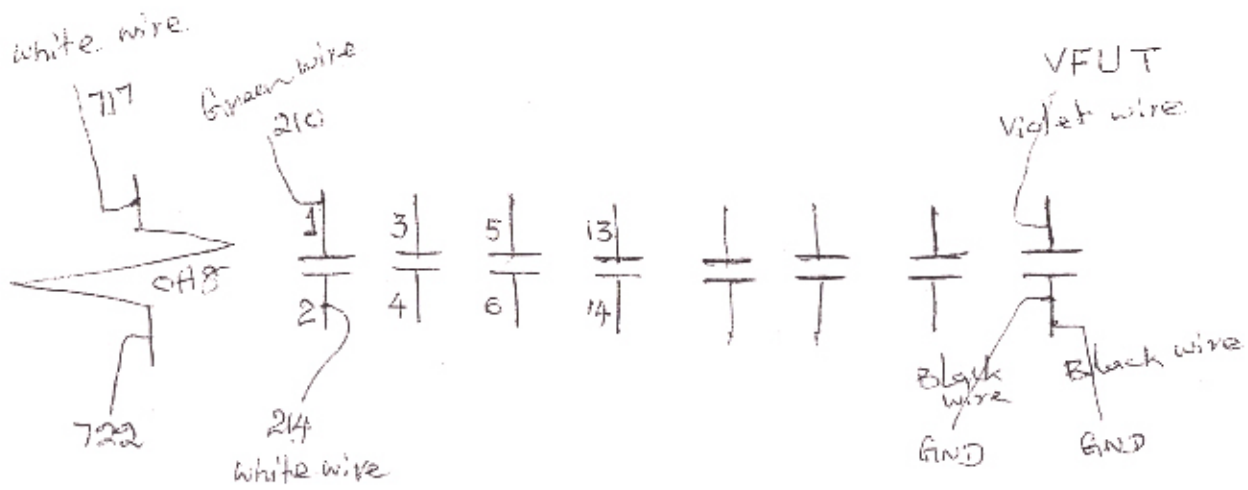
HTXT

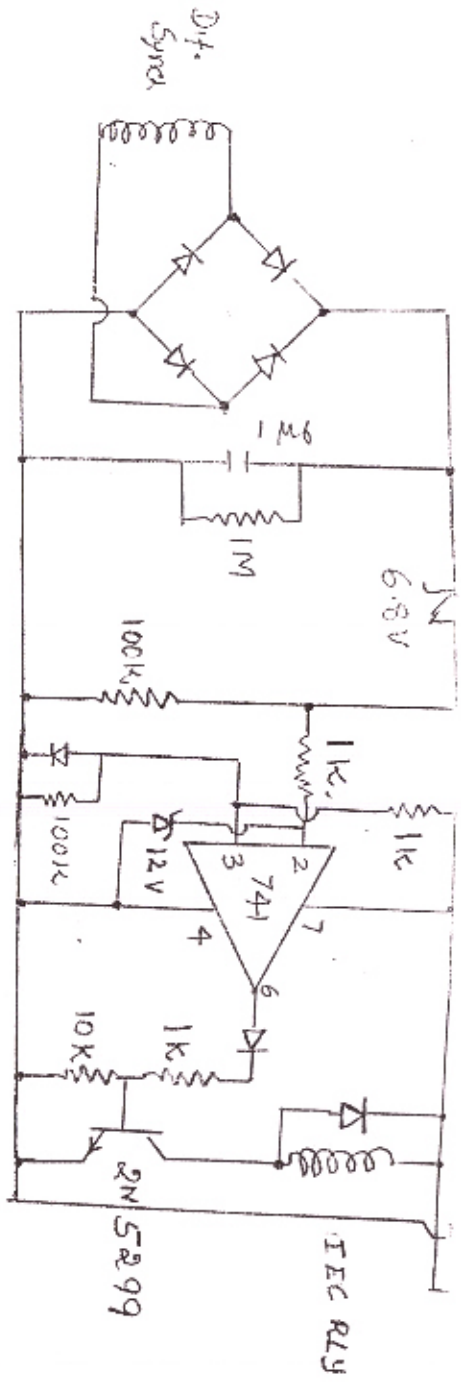
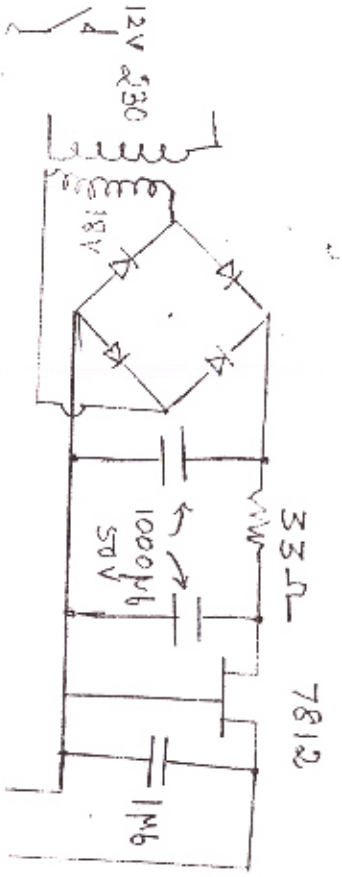
246 A goes to MA 2 C/O

# Variable Motor Power



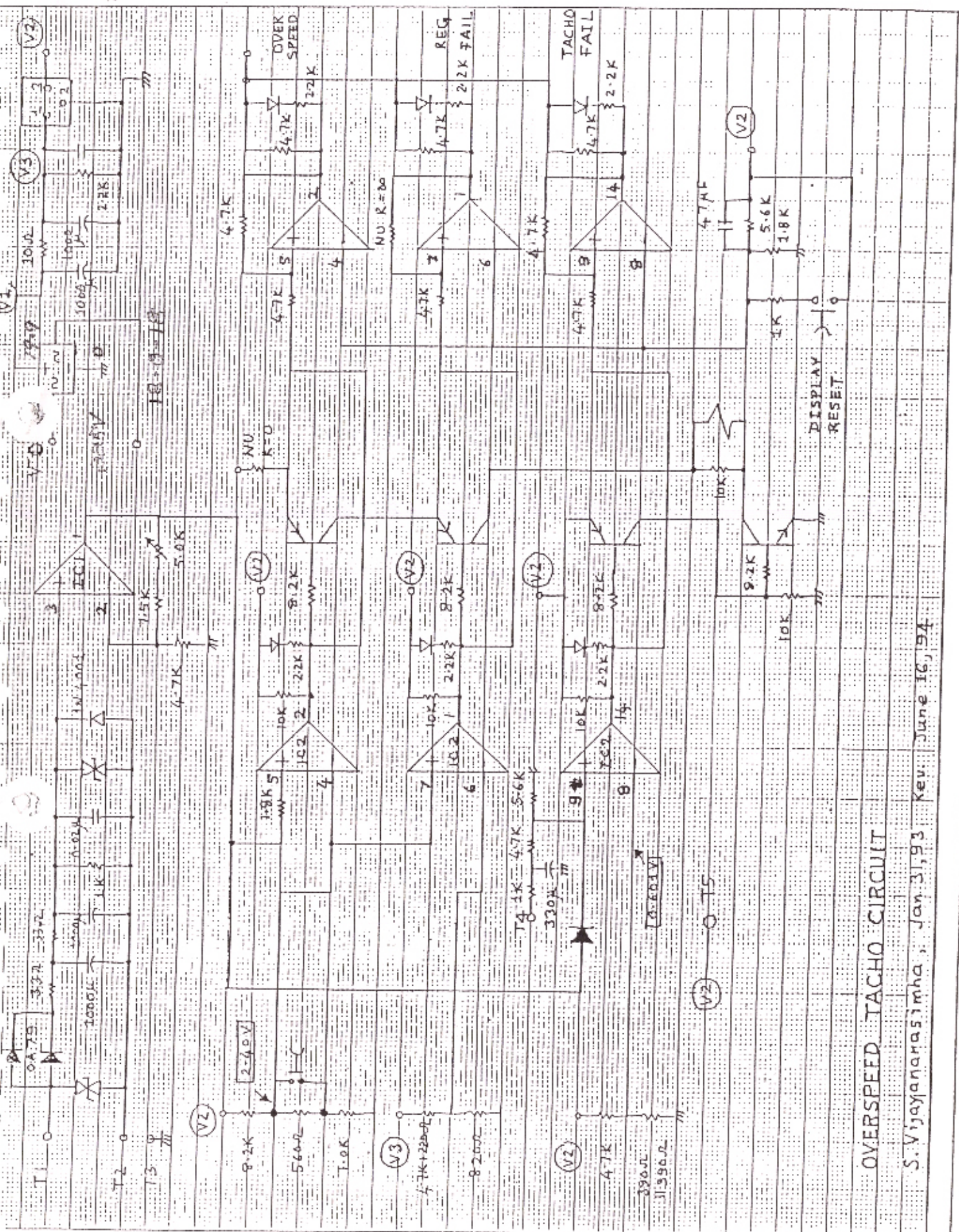






ALL DIODES 1N4007





OVERSPEED TACHO CIRCUIT

S. Vijayanarasimha, Jan 31, 93 Rev. June 16, 94

Copy To : Shri AJSN

## NOTES ON THE OVERSPEED TACHO SYSTEM

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Radio Astronomy Centre, P.O. Box 0, Udhagamandalam-643001.

July 12, 1994

We set down here some notes on the OS tacho system to bring the performance parameters to larger notice so that any suggestions can be incorporated.

The performance of the system under the various conditions is as below

- |   |   |
|---|---|
| Case 1 : Overspeed while the telescope is running<br>(The telescope speed exceeds 15% of the normal speed ) | The telescope stops in less than 1 second.        |
| Case 2 : Overspeed as the telescope is started  | The telescope stops in less than 2 seconds        |
| Case 3 : Tacho failure when telescope is running  | The telescope stops in less than 2 seconds        |
| Case 4 : Tacho failure and the telescope is started   | The telescope stops in about <u>8.9 seconds</u> . |
| Case 5 : Regulator failure when telescope is not running  | The telescope cannot be started.                  |
| Case 6 : Regulator failure when telescope is running  | The telescope stops immediately.                  |
| Case 7 : AC voltage drops below 179 volts when telescope is not running                                     | The telescope cannot be started.                  |
| Case 8 : AC voltage drops below 179 volts when telescope is running   | The telescope stops immediately.                  |

In all the above cases the telescope operation is stopped by tripping the control supply.

It is seen from above that the performance is satisfactory except in Case 4. We discuss case 4 below.

### Discussion on Case 4

---

This pertains to the initial bypass circuit. The initial bypass circuit used by us is given in fig 1. It is seen from experiment on the tower that if the initial bypass time (ie the time for which the

telescope would work if the tacho voltage does not develop ) is kept lower than about 5 seconds the telescope was stopping immediately after the initial bypass time .The only delay coming in the circuit is in the filter circuit used for rectifying the 5 Hz tacho output.This time constant is about 2 seconds and cannot be reduced further as this would lead to excess ripple.We can however bring the delay in the rise of input to the comparison level to about 1 sec by varying the comparison level itself.This leads to the conclusion that a delay of about 3 to 4 seconds is coming from outside the system.

#### Some experiments :

We have done some experiments and found that the batch of OA79 diodes used by us was giving more drop than the typical data sheet values.We plan to use OA91 diodes which show lesser voltage drops.It is seen that this however could lead to reduction of the required initial bypass time by only about 0.5 seconds.

#### The previous circuit :

The circuit that was given to me by Shri A.M.Batcha is given in fig 2.This circuit indicates a time constant of 0.33 seconds leading to an initial bypass time of 0.93 seconds.Dr V.Balasubramanian also informed me after talking to Shri A.M.Batcha that the initial bypass time should be reduced to less than 2 seconds.

I have now traced the values of the components in the initial bypass circuit in the earlier OS tacho circuits at the servo structure.The values of the components for the Slew and Track circuits is given in figs 3 and 4 respectively.These are different from that shown in fig 1.It is seen that

Initial Bypass time for  
Slew Circuit = 20.0 seconds.

Initial Bypass time for  
Track circuit = 34.1 seconds

#### Concluding remarks

The present OS tacho circuit installed by us has an initial bypass time of about 9 seconds.This is compared with the initial bypass time in the previous circuit(which was in operation for the past 20 years) of 20 seconds.It is clear that sufficient experiment is done by Shri N.V.Nagarathnam and the delays were fixed.

As the initial bypass time of 9 seconds or 20 seconds is sufficiently large clearly a case arises when telescope is not as safe as could be wished.

Thus the circuit performance as of now is satisfactory and in no way worse than the previous circuit.When telescope time is available we will try to bring down the initial bypass time to about 7 seconds. To reduce the time below this may not be possible without a thorough investigation of where the delay is being caused.This would also require extensive co-operation from the electrical section.

Critical Comments/Suggestions from Shri N.V.Nagarathnam and Prof G.Swarup will be very useful.In particular suggestions on reducing initial bypass time to less than 2 seconds is solicited.

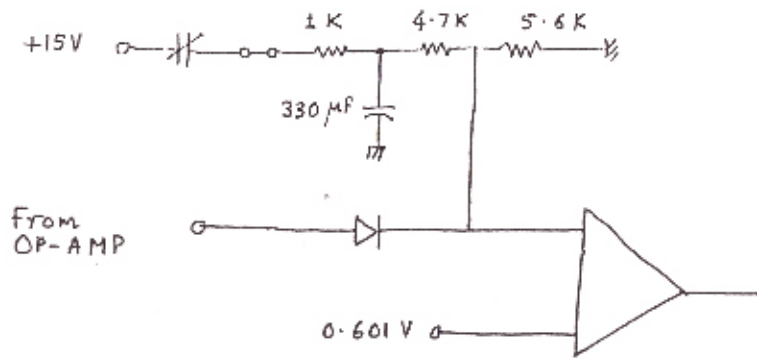


Fig 1. Initial bypass circuit used by me in the New OS Tacho circuit.

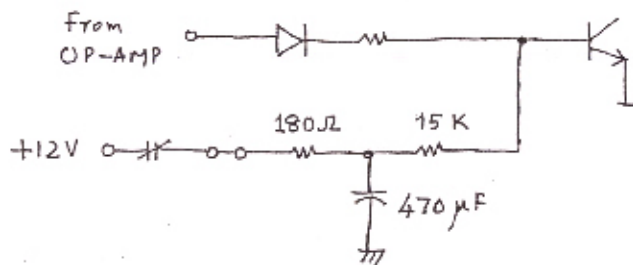


Fig 3. Initial bypass circuit in the earlier Slew Tacho circuit

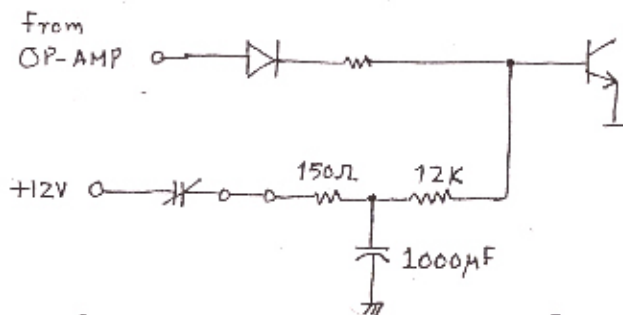


Fig 4. Initial bypass circuit in the present Track tacho circuit. (This has not been replaced by me)

# OVERSPEED TACHO CIRCUIT

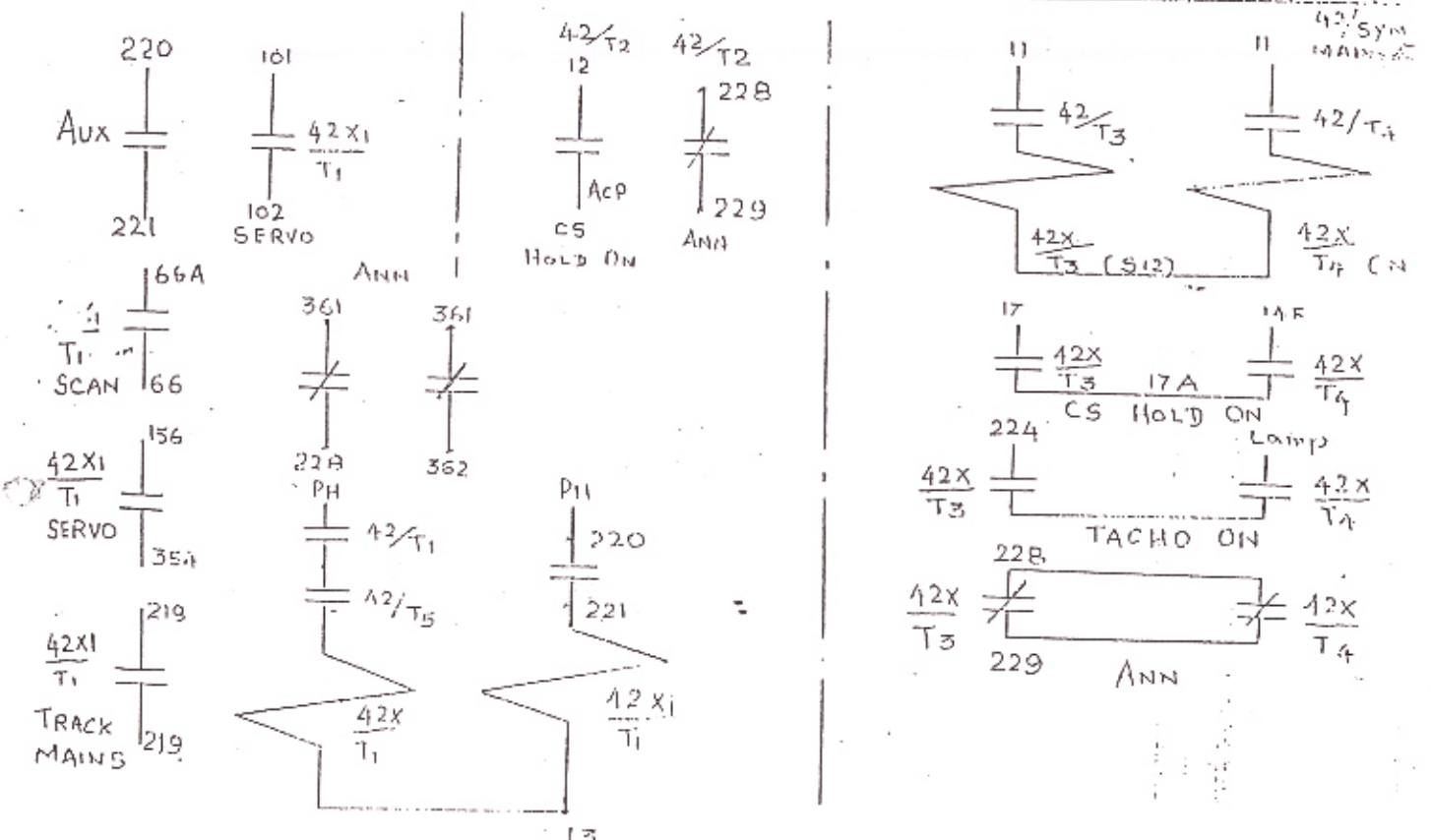
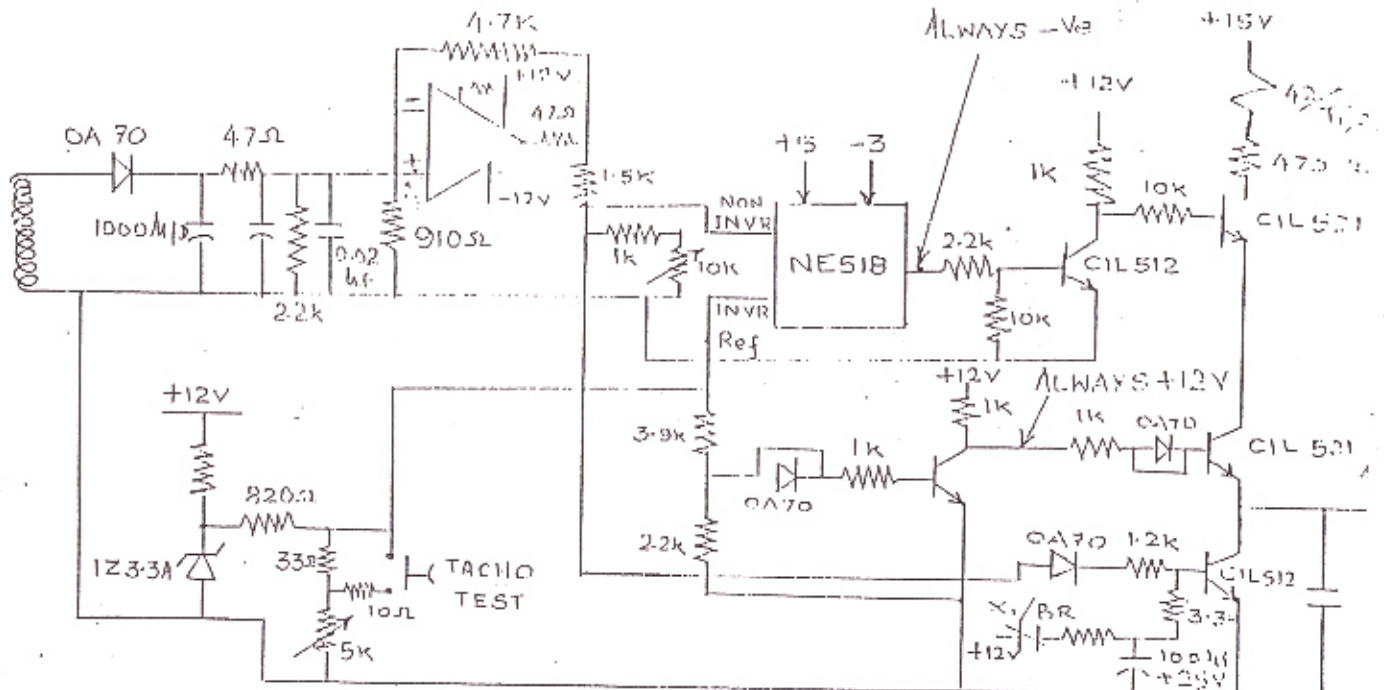
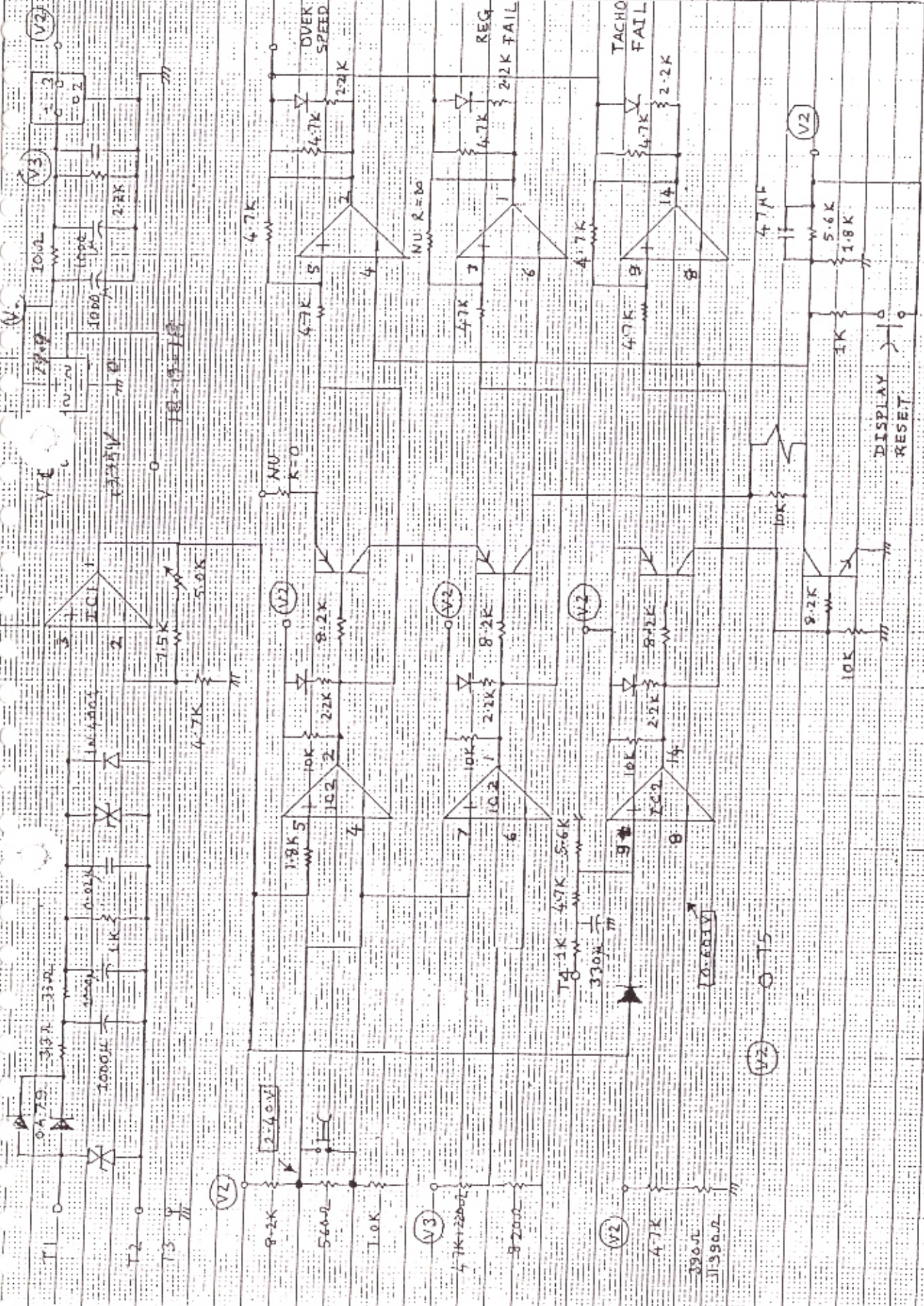


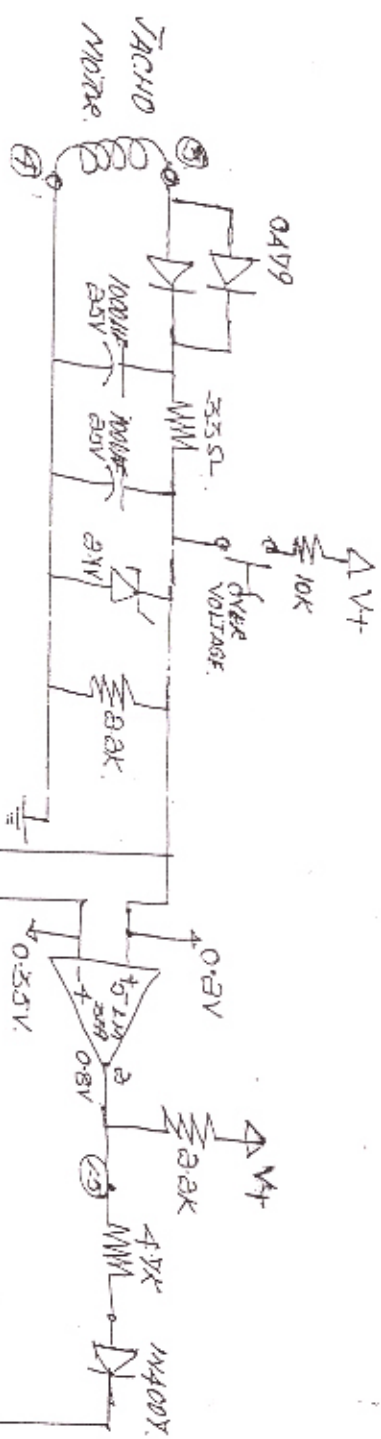
Fig. 2. OS Tacho Circuit given by Shri A. M. Barcha.  
 Note that the initial bypass circuit values are  $R = 3.3K$  and  $C = 100\mu F$ . In the circuit connected to telescope the values are  $R = 12K$  and  $C = 470\mu F$ .



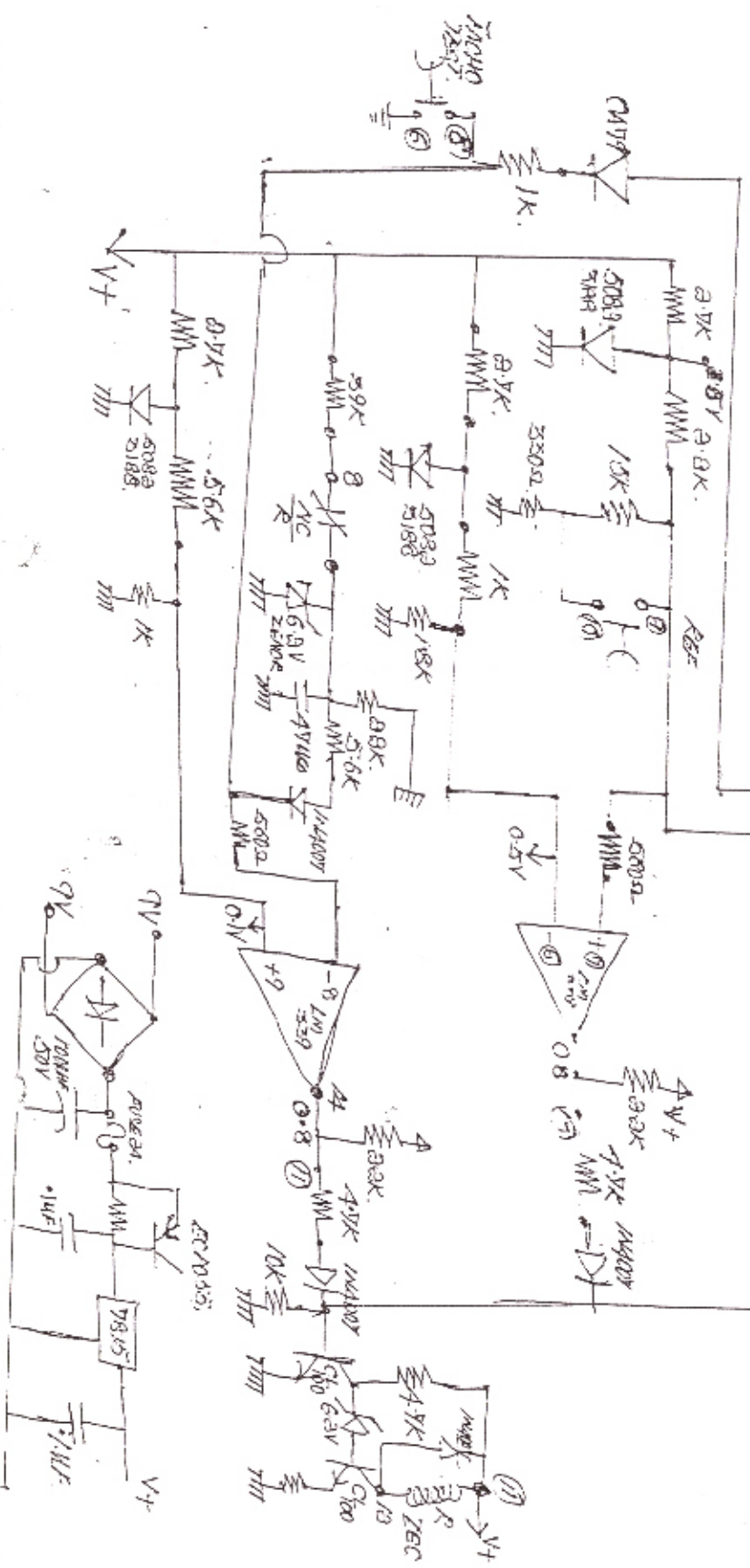
# OVERSPEED TACHO CIRCUIT

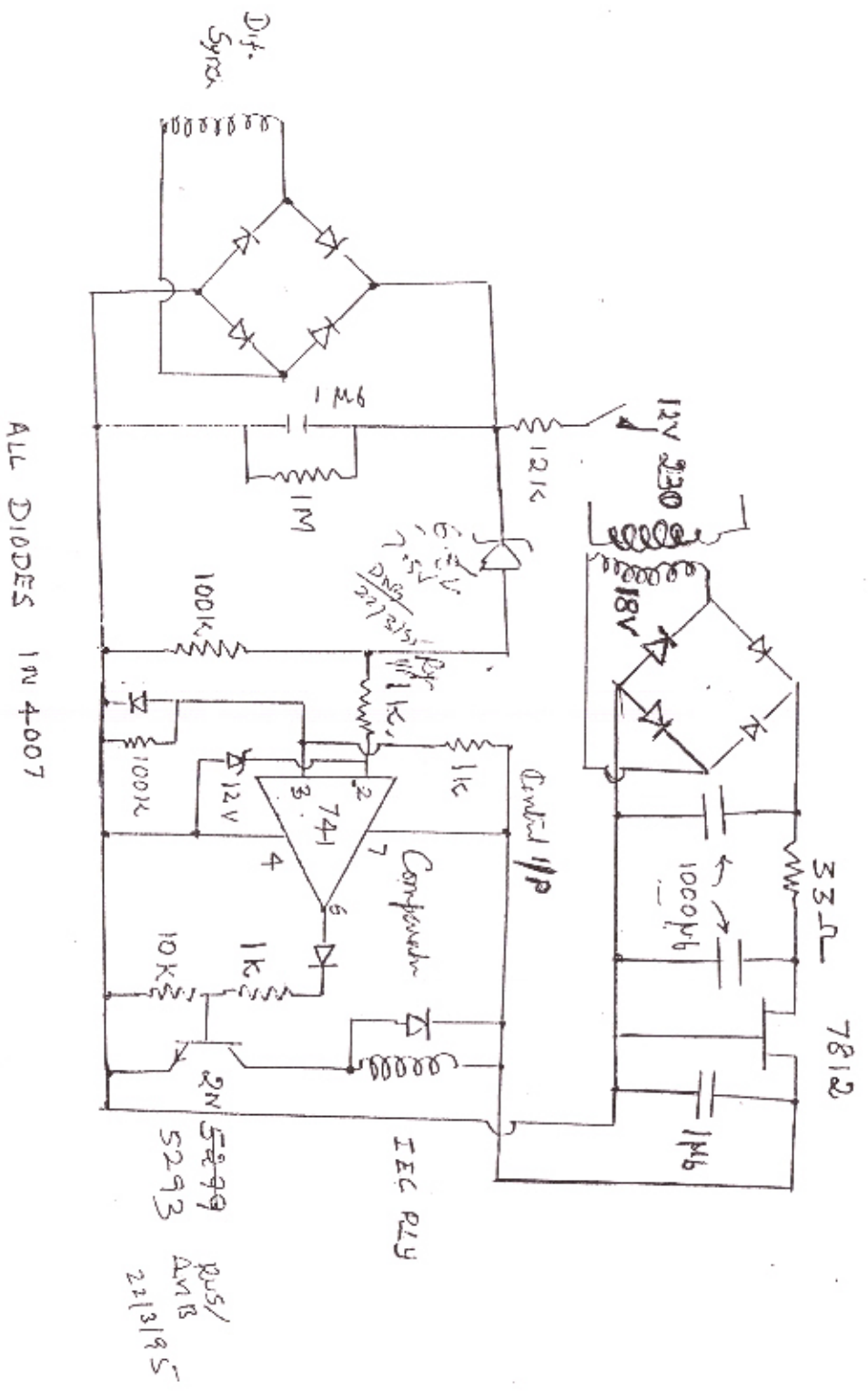
S. Vijayanamasimha, Jan 31, 93 Rev. June 16, 94

OVER SPEED TACHO.



LM559-AN-5 715V  
PIN. 12 Ground.





Synchro ~~is~~ input voltage  
to comparator 6.8V Zener  
diode replaced by 7.5V  
22/3/95



# IDENTIFICATION OF WIRES FOR VARIOUS CIRCUITS

## (1) UNDERVOLTAGE CIRCUITS

LOCATED IN MCC.  $\frac{27}{AB}$  &  $\frac{27}{BC}$  CONTACTS FOR CONTROL SUPPLY ARE 17 AND A TERMINAL OF  $\frac{42}{CS}$

(2) OVERVOLTAGE PROTECTION IN SERIES WITH THE ABOVE CONTACT 17 & 17A

## (3) OVERSPEED TACHO CIRCUITS

I TACHO SUPPLY SELECTOR SWITCH IN MCC

II  $\frac{42}{T1}$  SCAN/ TRACK RELAY

$\frac{42}{T2}$  SLEW RELAY

$\frac{42}{T5}$  COMMON CLUTCH PROTECTION TACHO RELAY

$\frac{42}{T4}$  N12 TACHO RELAY

$\frac{42}{T3}$  S12 TACHO RELAY

} SS

III  $\frac{42}{T2}$  CONTACT 12 & 12A FOR CONTROL SUPPLY

$\frac{42}{T3}$  CONTACT 230 & 231 TO ACTUATE  $\frac{42x}{T3}$

$\frac{42}{T4}$  CONTACT 232 & 233 TO ACTUATE  $\frac{42x}{T4}$

} SLEW

SCAN/ TRACK  $\frac{42}{T1}$  TO ACTUATE  $\frac{42x}{T1}$

$\frac{42x}{T1}$  1N0 TO ACTUATE  $\frac{42x}{T1}$  IN MCC

INC TO ANNUNCIATION CIRCUITS

INC TO TACHO LAMP FLIP-FLOPS

$\frac{42}{T5}$  CONTACT CONNECTED IN SERIES

WITH  $\frac{42}{T1}$  CONTACT

(4) MISALIGNMENT LOOP SYSTEM

MA - 1 EAST

END N12 238 TO 240 S12 END +ve WIRE

N12 239 TO 241 S12 -ve WIRE

240B TO 306 MA RELAY 1

MA - 2 WEST

END N12 242 TO 244 S12 END +ve WIRE

N12 243 TO 245 S12 -ve WIRE

309 TO 244B MA RELAY 2

CONTROL SUPPLY CONTACTS 14, 14A & 14A, 14B

1

2

(5) DIFFERENTIAL SYNCHRO CIRCUITS

237, 238 50VOLTS INPUT TO S12 TRANSMITTER

234, 235 SYNCHRO TRANSFORMER OUTPUT FROM S12

TO DSR CIRCUIT S/D NVN ON 2-11-76

DSR CONTACT TO CONTROL SUPPLY IS 14B & 14C

DS/CO CONTACT IS 14C & 14D

(6) MASTER/CO CONTACT IS 14D & 14E.

EMERGENCY PB AND CRUSH TYPE EMERGENCY

LIMIT SWITCHES ARE FROM 12 TO 16

II

# LIMIT SWITCH CIRCUIT

(i) EAST

PH. 20 → N1 EAST LIMIT SWITCHES ON NORTH AND SOUTH → 32

32 To S1 AND RETURN TO N1 AS 31

31 → a TERMINAL OF  $\frac{RE}{LS}$

NE 22 → b TERMINAL OF  $\frac{RE}{LS}$

PB - LS - E POINTS ARE 31 AND 34A  
BY PASS

(ii) WEST

20 → WEST LIMIT SWITCHES ON NORTH AND SOUTH - 34

GOES TO S1 AND RETURNS AS 33 TO N1

33 → a TERMINAL OF  $\frac{RW}{LS}$

22 → b TERMINAL OF  $\frac{RW}{LS}$

PB - LS - W ARE 33 AND 110  
BY PASS

END 20 - 110 - 34A

34A - a TERMINAL OF  $\frac{RW-END}{LS}$

22 - b TERMINAL OF  $\frac{RW-END}{LS}$

## THERMAL RELAYS

1)	SLM	CIRCUIT	49X/SLM	
	20-72	49/SLM-1	BYPASS POINTS	20-72
	72-71	49/SLM-2	BYPASS POINTS	72-71
	71-70	49/SLM-3		
	70-38A	49/SLM-4		
2)	20 & 20A	49/SCM		
3)	20 & 20B	49/TRACK		

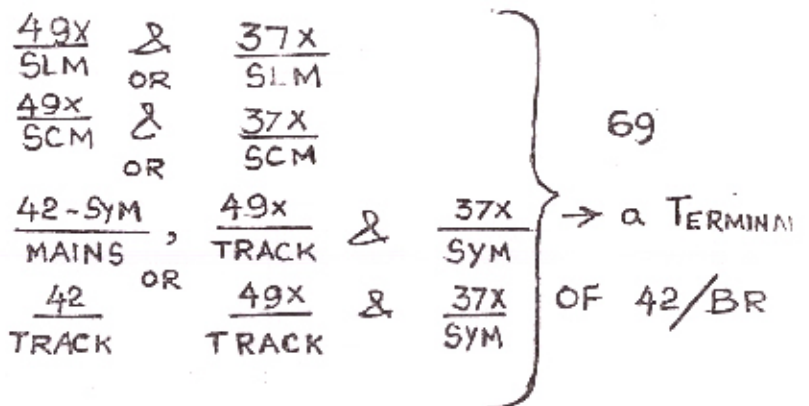
## UNDER CURRENT RELAYS

1	SLM	CIRCUIT		
	35 - 52A	& 51	<u>37,ABC</u> SLM-1	
	51 To	50	<u>37,ABC</u> SLM-2	48A AND NE
	50 To	49	<u>37,ABC</u> SLM-3	FOR
	49 To	48A	<u>37,ABC</u> SLM-4	<u>37X</u> SLM
2	SCM	CIRCUIT	35 TO 35A	<u>37,ABC</u> SCM
				35A & NE
				FOR <u>37X</u> SCM
3	SYM	CIRCUIT	256 & 257	<u>37A,B,C</u> SYM
				257 & NE
				FOR <u>37X</u> SYM

## BRAKES

- (i) 68A & 68 To 2/BR a TERMINAL
- (ii) 79 THROUGH 2/BR TD CONTACT TO X/BR a TERMINAL 79  
79A IS 35 THROUGH X<sub>1</sub>/BR & X<sub>2</sub>/BR.
- (iii) X<sub>1</sub>/BR RELAY IS THROUGH 73, 74, 75 (NORTH)
- (iv) X<sub>2</sub>/BR RELAY IS THROUGH 76, 77, 78
- (v) 42/BR IS 69

35 THROUGH



## CLUTCHES

- (i) SCAN CLUTCH 84 & 83
- TRACK CLUTCH 82 & 83
- SCAN/TRACK CLUTCH RELAY 81A & 81B
- (ii) COMMON CLUTCH 80 & 83
- COMMON CLUTCH RELAY 81A AND 81B

ANTENNA POSITION INDICATER

85  $\phi$  86      110VOLTS      SECONDARY  
HOURS      SYNCHRO      87 88 89  
MINUTES      SYNCHRO      90, 91 , 92  
SECONDS      SYNCHRO      104, 105, 106

WAIT A MINUTE

258 - 259 - 259D      259D - a TERMINAL

PB-STOP  
SERVO

ACP.

R3 NEUTRAL b TERMINAL

2-STOP  
TDFU

2-CS/TDFU ,       $\frac{MA-1}{CO}$  ,       $\frac{MA-2}{CO}$  ,       $\frac{DS}{CO}$  ,       $\frac{MASTER}{CO}$

2-TS/TDFU       $\frac{2-MAR}{TDFU}$  ,       $\frac{2-MAR2}{TDFU}$

SEE THE DETAILED DRAWINGS

SLM CIRCUIT

$\frac{42X}{SLM} \left\{ \begin{array}{l} \text{EAST } 35, 52A, 52, 48A, 48, 47, 46, 42 \\ \text{WEST } 35, 52A, 52, 48A, 45, 44, 43, 42 \end{array} \right.$

42, 38, 37, 36, 22

42/SLM C20, C19  $\left\{ \begin{array}{l} \text{C19, C18, NE} \rightarrow \text{EAST} \\ \text{C19, C17, NE} \rightarrow \text{WEST} \end{array} \right.$

SCM CIRCUIT

$\frac{42X}{SCM} \left\{ \begin{array}{l} \text{EAST} \\ \text{WEST} \end{array} \right. 35, 61A, 61, 61A, \left\{ \begin{array}{l} 56, 57, 58 \\ 62, 63, 64 \end{array} \right\} 59, 60, 65, 66A, 66, 22$

EAST  
WEST C16, C15  $\left\{ \begin{array}{l} \text{C14, C15 NE} \\ \text{C14, C12, NE} \end{array} \right.$

SYM CIRCUIT

42 SYM/MAINS 35, 201, 203, 202, 246, 218, 219

IL  
CS - SERVO

SERVORACK CONTROL SUPPLY

IL-READY  
SERVO/TRACK

SERVO SYSTEM READY FOR TRACKING

IL  
DS/TS

DIFFERENTIAL SYNCHRO / TACHO  
SUPERVISION

PB. PUSH BUTTON

PB - CS  
ON/OFF

CONTROL SUPPLY

PB - STOP  
SLM/SCM

SLEWING MOTORS / SCANNING MOTOR  
STOP

PB - START  
SLM/SCM-E/W

SLEWING/SCANNING EAST WEST / START

PB - STOP / START  
TRM - I / SERVO

TRACKING MOTOR STOP/START  
FROM ACP/SRH - I

PB - MA  
BY PASS

KEY OPERATED PB FOR BY PASSING  
MAR (KEY TO BE WITH RESPONSIBLE  
HIGHER AUTHORITY)



IL: INDICATION LAMPS.

IL  
CS/CL - SUPPLY

CONTROL / CLUTCH-POWER - SUPPLY  
SUPERVISION

IL  
EAST

TELESCOPE MOVING EAST

IL  
WEST

TELESCOPE MOVING WEST

IL  
SLEW/SCM/TRM

SLEWING / SCANNING / TRACKING MOTOR  
RUNNING

IL - SYM  
MAINS

TRACKING (SYNCHRONOUS) MOTOR  
RUNNING FROM MAINS

IL  
CL

CLUTCH ENGAGED

IL-LS  
E/W/END

TELESCOPE EAST / WEST / EXTREME EAST  
OR WEST LIMIT POSITION

IL  
UV

UNDERVOLTAGE SUPERVISION

IL  
TRACK

TELESCOPE TRACKING

IL  
MA

MISALIGNMENT SUPERVISION

CONTACTORS

$\frac{42X}{SLM/SCM/TKM}$

$\frac{42}{SLM/SCM/TKM}$

$\frac{42}{T}$

$\frac{42X}{T_1,2,3,4,5}$

$\frac{42}{BR}$

$\frac{X}{BR}$

$\frac{X_1}{BR}, \frac{X_2}{BR}$

$\frac{R}{CL}$

DSR

AUXILIARY CONTACTOR

MAIN CONTACTOR ( SLEW MOTOR,  
SCAN MOTOR, TRACK MOTOR )

MAIN TACHO CONTACTOR

AUXILIARY CONTACTOR (TACHO)

MAIN BRAKE CONTACTOR

AUXILIARY BRAKE CONTACTOR

AUXILIARY BRAKE RELAYS

CLUTCH RELAYS

DIFFERENTIAL SYNCHRO RELAY

MAR - 1/2

MISALIGNMENT LOOP RELAYS

MA1 - EAST , MA2 - WEST

 $\frac{37}{\text{SLM/SCM/TKM}}$ 

UNDER - CURRENT RELAYS

 $\frac{37x}{\text{SLM/SCM/TKM}}$ 

AUXILIARY UNDERCURRENT CONTACTOR

 $\frac{49}{\text{SLM/SCM/TKM}}$ 

THERMAL RELAY

 $\frac{49x}{\text{SLM/SCM/TKM}}$ 

AUXILIARY THERMAL CONTACTOR

 $\frac{2}{\text{BR}}$ 

TIME DELAY BRAKE CONTACTOR

 $\frac{27}{\text{UV}}$ 

UNDER VOLTAGE RELAYS

43

SELECTOR ACTUATORS

X

AUXILIARY

PB-P<sub>1</sub>/P<sub>2</sub> - START  
TRACK

TRACKING FROM ACP (P<sub>1</sub>)/  
SR#1 (P<sub>2</sub>) 'START'

PB-STOP/START  
SYM-MAINS

TRACKING FROM 'MAINS'

PB-LSE/W/END  
BY PASS

FOR BYPASSING LIMIT SWITCHES EAST/  
WEST/EXTREME ON TELESCOPE

PB-TEST  
TACHO

TACHO RELAY TEST

PB-TEST  
MA +VE/-VE WIRE

+VE WIRE/-VE WIRE CONTINUITY  
TEST IN MISALIGNMENT DETECTOR  
SYSTEM

PB-TEST  
MA

MISALIGNMENT RELAY TEST

CO - CUT OUT SWITCH

43-SELECTOR SWITCH

RS-REVERSING SWITCH

43-SLM  
BY PASS

FOR BYPASSING ANY ONE OF  
FOUR SLEWING MOTORS

43-MA  
BY PASS

FOR BYPASSING ANY ONE OF THREE  
MISALIGNMENT DETECTION SYSTEMS

43-SYM  
MAINS/SERVO

FOR OPERATING TRACKING (SYNCHRONOUS)  
MOTOR FROM MAINS OR SERVO SYSTEM

MA/DS  
CO

MISALIGNMENT WIRE-LOOPS OR  
DIFFERENTIAL SYNCHRO SYSTEM

MASTER  
CO

KEY OPERATED MASTER CO

PB-CL  
TEST

CLUTCH TEST

2: TIME DELAY RELAY

TDFU: TIME DELAY ON PICK UP (ON DELAY)

TDDO: TIME DELAY ON DROP OUT (OFF DELAY)

2/BR

FOR MOTOR & BRAKE CIRCUITS

INITIATION, RANGE: 0-150 MS

2-STOP  
TDFU

RANGE 0-3 MIN, SETTING 2 1 MIN FOR  
LOCKING ANTENNA OPERATION FOR  
MINM. 1MIN

42-TRACK  
TDPU/ TDDO

RANGE 0-3 MIN, FOR TRACKING  
MOTOR CONTROL CIRCUIT

2X- STOP  
TDPU

AUX-RELAY FOR MULTIPLYING CONTACTS  
OF 2-STOP/TDPU

2-MAR  
TDPU

RANGE 0-3 MIN, FOR ANNUNCIATION  
CIRCUITS OF MAR1 & MAR2

2-TS/CS  
TDPU

FOR TACHO/ LIMIT SWITCH & MOTOR TRIP  
ANNUNCIATION CIRCUITS, RANGE 0-3 MIN

37: UNDER CURRENT RELAY,

42: CONTACTOR

27: UNDER VOLTAGE RELAY,

49: THERMAL OVERLOAD RELAY

X: AUXILIARY RELAY/ UNIT.

42  
SLM/SCM - E/W

SLEWING/ SCANNING MOTOR, EAST/WEST

42X  
SLM/SCM - E/W

SLEWING/ SCANNING MOTOR, EAST/WEST

42 - SYM  
MAINS/ SERVO

TRACKING MOTOR CONTACTOR FROM 'MAINS/  
'SERVO SYSTEM'

42  
TRM

FOR POWER SUPPLY TO SERVO SYSTEM

42  
T

TACHO INTERLOCKING RELAY FOR  
OVERSPEED PROTECTION

42  
TRACK

FOR TRACKING OPERATION

42  
BR

FOR BRAKE

42X  
T<sub>1</sub>, T<sub>3</sub>, T<sub>4</sub>

AUX RELAY FOR 42/T<sub>1</sub> FOR  
MULTIPLYING CONTACTS

42  
CS

FOR CONTROL SUPPLY

27- AB/BC  
M

CONNECTED BETWEEN A & B / B & C  
PHASES OF INCOMING SUPPLY TO MCC

49  
SLM/SCM/TRACK

FOR SLEWING / SCANNING / TRACKING  
(SYNCHRONOUS) MOTOR

37A/B/C  
SLM/SCM/TRACK

FOR SLEWING/ SCANNING/ TRACKING  
MOTOR ON A/B/C PHASE

37x/49x  
SLM/SCM/SYM

AUX - RELAY FOR 37/49  
SLM/SCM/TRACK

OTHER RELAYS

R-E/W/END  
LS

AUXILIARY RELAY OPERATED BY:  
EAST/WEST/ EXTREME EAST & WEST  
LIMIT SWITCH

X1/X2/X3  
BR

BRAKE POSITION INDICATING RELAY

X  
BR

AUXILIARY BRAKE CONTACTOR

MAR/DSR

MISALIGNMENT RELAY OPERATED BY  
'WIRE & LOOP'/DIFFERENTIAL SYNCHRO SYSTEM

P1/P2

PANEL SELECTION CONTACTOR FOR  
SERVO SYSTEM OPERATION, ENERGISED  
BY PANEL SELECTOR SWITCH.



R  
LATCH

LATCHING RELAY: PREVENTS ENGAGING OF TRACKING MOTOR TO ANTENNA FOR A PRESET DURATION AFTER ENERGISATION OF 42/TRM-1/2. ALLOWS SUFFICIENT TIME FOR SERVO SYSTEM TO STABILIZE.

R/RX  
TACHO

TACHO RELAY: PREVENTS ENGAGING OF TRACKING MOTOR TO ANTENNA UNTIL IT HAS PICKED UP NORMAL SPEED.

R  
CL

CURRENT OPERATED RELAY TO SENSE CLUTCH OPERATION

CL

CLUTCH COIL

X - SYM  
MAINS/SERVO

AUXILIARY FOR MULTIPLYING CONTACT OF SELECTOR SWITCH 43 - SYM / MAINS / SERVO

LS: LIMIT SWITCH  
BRN - 1 TO 14

LIMIT SWITCH NORTH SIDE  
BRAKES

BRS- 1 TO 14

LIMIT SWITCH SOUTH SIDE  
BRAKES

ALS - E/W

ADJUSTABLE LIMIT SWITCH  
EAST/WEST DRIVEN BY POSITION  
INDICATING SYNCHROS IN ACP

LS-E/W  
SN

EAST & WEST AND (EXTREME EAST)  
WEST LIMIT SWITCHES LOCATED  
ON TELESCOPE STRUCTURES ON  
SOUTH / NORTH SIDE OF DRIVE  
SECTOR

LS-END - E/W  
SN

LS  
EMERG

EMERGENCY LIMIT  
SWITCH

BILL OF MATERIAL FOR ORT 52 1

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	MAKE & REMARKS IF ANY
	PUSH BUTTONS				
1	<u>PB-CS</u> ON	1NO	1NO FOR CS-ON	ACP	L&T key ACTUATOR
2	<u>PB-CS</u> OFF	1NC	1NC FOR CS-OFF	MCC ACP SRH2 SS(2) N10 N4, S4, S10	L&T MUSH ROOM
3	<u>PB-LS(E)</u> BYPASS	1NO	FOR BYPASSING LIMIT SWITCH	ACP	L&T KEY ACTUATOR
4	<u>PB-LS(W)</u> BY PASS	1NO	-DO-	ACP	-DO-
5	<u>PB-LS(END)</u> BY PASS	1NO	-DO-	ACP	-DO-
6	<u>PB-STOP</u> SLM	1NC 1NC	FOR STOP CONTACT FOR <u>2-STOP</u> TDFU	ACP	L&T UNSHROUDED
7	<u>PB-START</u> SLM-E	1NO+1NC	1NO FOR START SLEW 1NC FOR BRAKE ANN	ACP	L&T SHROUDED
8	<u>PB-START</u> SLM-W	1NO	FOR START SLEW FOR BRAKE ANN	ACP	L&T SHROUDED
9	<u>PB-STOP</u> SCM	2NC	SCM STOP 2-STOP/TDFU	ACP	L&T UNSHROUDED
10	<u>PB-START</u> SCM-E	1NO+1NC	NO FOR SCM START NC FOR BRAKE ANN	ACP	L&T SHROUDED

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	MAKE REMARKS IF ANY
11	<u>PB-START</u> SCM-W	1NO+1NC	NO FOR SCM START NC FOR BRAKE ANN	ACP	L&T SHROUDED
12	<u>PB-P1-START</u> TRACK	1NO 1NC	FOR START BRAKE ANN	ACP	L&T SHROUDED
13	<u>PB-STOP</u> SERVO (TRM1)	2NC	FOR STOP SERVO FOR 2-STOP/SERVO	ACP	L&T UNSHROUDED
14	<u>PB-START</u> SERVO	2NO	FOR START TRM1 FOR START R/LATCH	ACP	L&T SHROUDED
15	<u>PB-STOP</u> SYM-MAINS	2NC	FOR STOP SYM FOR 2-STOP/TDPU	ACP	L&T UNSHROUDED
16	<u>PB-START</u> TRACK-MAINS	1NO+1NC	FOR START FOR BRAKE ANN	ACP	L&T SHROUDED
17	<u>PB-CL3</u> TEST	1NO	1NO FOR SUPPLYING POWER TO COMMON CLUTCH	ACP	L&T SHROUDED
18	<u>PB-CL2</u> TEST	1NO	FOR SUPPLYING POWER TO SCAN CLUTCH	ACP	L&T SHROUDED
19	<u>PB-CL1</u> TEST	1NO	FOR SUPPLYING POWER TO TRACKING CLUTCH	ACP	L&T SHROUDED
20	<u>PB-MA1</u> TEST	3NO+1NC	SEE DIAGRAM	ACP	L&T SHROUDED

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	MAKE & REMARKS IF ANY
21	<u>PB-MA1</u> +VE WIRE TEST	1NO+2NC	SEE DIAGRAM	ACP	L&T SHROUDED
22	<u>PB-MA1</u> -VE WIRE TEST	1NO+2NC	SEE DIAGRAM	ACP	L&T SHROUDED
23	<u>PB-MA2</u> TEST	3NO+1NC	-DO-	ACP	-DO-
24	<u>PB-MA2</u> +VE WIRE TEST	1NO+2NC	-DO-	ACP	-DO-
25	<u>PB-MA2</u> -VE WIRE TEST	1NO+2NC	-DO-	ACP	-DO-
26	<u>PB-TEST</u> TACHO-1	1NO	FOR SHORTING 10 $\Omega$ TO 33 $\Omega$ IN PARALLEL	-DO-	-DO-
27	<u>PB-TEST</u> TACHO-2	1NO	-DO-	-DO-	-DO-
28	<u>PB-STOP</u> SERVO	2NC	1 FOR STOPPING 1 FOR 2STOP/TDPV	SR#1	L&T UNSHROUDED
29	<u>PB-START</u> SERVO	2NO+1NC	1NO FOR STARTING 1NO FOR LATCH 1NC FOR BRAKE FAILURE ANN	SR#1	L&T SHROUDED

# SELECTOR AND CUTOUT SWITCHES

55

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	<u>43-SLM</u> BY PASS	8NDS	1NO FOR SLM-1 THERMAL RELAY	ACP	
2	<u>43-MA</u> BY PASS	2NDS	1NO FOR CAG RELAY SWITCH FOR 4 SLMS 1NO FOR MAR-1 1NO FOR MAR-2	ACP	L & T SELECTOR ACTUATOR
3	<u>43-SYM</u> MAINS/SERVO	1NC + 4NO	1NC FOR SYM-MAINS 4NO FOR SERVO	ACP	L & T KEY ACTUATOR LOCKABLE IN "IN" POSITION
4	<u>DS</u> CO	3NDS	1NO FOR CS 1NO FOR INPUT AC POWER 1NO FOR OUTPUT AC VOLTAGE	ACP	-DO-
5	<u>MA-1</u> CO	2NDS	1NO FOR MAR-1 1NO FOR 2MAR-1/TDPU	ACP	-DO-
6	<u>MA-2</u> CO	2NDS	1NO FOR MAR-2 1NO FOR 2-MAR-2/TDPU	ACP	-DO-
7	<u>MASTER</u> CO	1NO 2NC	1NO FOR CS 1NC FOR ANN 1NC FOR ANTENNA DOWN NOT TO BE OPERATED	ACP	SIEMENS KEY ACTUATOR LOCKABLE IN TWO POSITION

# POWER SELECTOR SWITCHES

56

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	MCC POWER	3 NOS	200A TPN SWITCH	MCC	
2	CS ON	1 NO	10A DOUBLE POLE ON-OFF	MCC	
3	TACHO ON	1 NO	10A DOUBLE POLE ON-OFF	MCC	
4	BRAKES	1 NO	16A TRIPLE POLE ON-OFF	MCC	
5	SCAN MOTOR	3 NOS	16A TRIPLE POLE ON-OFF	MCC	
6	SLEW MOTOR	3 NOS	30A TRIPLE POLE ON-OFF	MCC	
7	TRACKING MOTOR	3 NOS	16A DOUBLE POLE ON-OFF	MCC	
8	SERVO RACK SUPPLY	3 NOS	30A TRIPLE POLE ON-OFF	MCC	
9	SLM HEATER	3 NOS	16A DOUBLE POLE ON-OFF	MCC	
10	MCC SPACE HEATER	3 NOS	16A DOUBLE POLE ON-OFF	MCC	

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	UNDER-VOLTAGE RELAY (MCC)				
	(i) $\frac{27AB}{M}$	1NO	FOR CONTROL SUPPLY CIRCUIT	MCC	ENGLISH ELECTRIC MAKE
		1NO	FOR UNDER VOLTAGE LAMP	MCC	
	(ii) $\frac{27BC}{M}$	1NO	FOR CONTROL SUPPLY CIRCUIT	MCC	
		1NO	FOR UNDER VOLTAGE LAMP	MCC	
2	$\frac{42}{CS}$ CONTROL SUPPLY MAIN CONTACTOR				
		1NO	FOR PB-CS/ON HOLD ON	MCC	
		1NO	FOR PHASE (20→35)		
		1NO	FOR NEUTRAL (13→22)		
		1NO	FOR TRACKING MOTOR PANEL		
3	LIMIT SWITCH RELAYS				
	$\frac{RE}{LS}$ EAST LIMIT SWITCH CONTACTOR				
		1NO	FOR SLM-E CCT	MCC	
		1NO	FOR SCM-E CCT		
		1NC	FOR EAST LIMIT INDICATION LAMP		
		1NC	ANTENNA END POSITION ANNUNCIATION		
4	$\frac{RW}{LS}$ WEST LIMIT SWITCH CONTACTOR				
		1NO	SLM-W CIRCUIT		
		1NO	SCM-W CIRCUIT		
		1NO	TKM PANEL		
		1NO	42SYM/MAINS CCT		
		1NC	WEST LIMIT LAMP		
		1NC	ANTENNA END POSITION ANN		



# RELAYS & CONTACTORS

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SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
5	<u>R</u> END LS END LIMIT SWITCH RELAY	1 NO	FOR CS DISCONNECTION	MCC	
		1 NO	TKM PANEL		
		1 NC	END LIMIT LAMP		
		1 NC	ANTENNA ENP POSITION ANN		
6	OVER SPEED RELAYS <u>42</u> SCAN/TRACK TACHO T1 RELAY	1 NO	FOR ACTUATING 42X/T1	SS	
7	<u>42x</u> T1 Aux -DO-	1 NO	ACTUATING 42X1/T1	SS	OH/B SIEMENS CONTACTOR
		1 NC	FOR OVER SPEED ANNUNCIATION		
		1 NC	FOR OVER SPEED ANNUNCIATION		
8	<u>42x</u> T1 Aux -DD-	1 NO	FOR TKM PANEL	MCC	-DO-
		1 NO	FOR SCAN CIRCUIT		
		1 NO	FOR <u>42-SYM</u> cct MAINS		
9	<u>42</u> SLEW TACHO T2 RELAY	1 NO	FOR CS HOLD ON	SS	
		1 NC	FOR OVER SPEED ANN		
10	<u>42</u> SLEW TACHO T3 OVER SPEED RELAY	1 NO	ACTUATING <u>42x</u> T3	S12	
11	<u>42x</u> T3 Aux -DO-	1 NO	CONTROL SUPPLY	ACP	-DO-
		1 NO	TACHO ON LAMP		
		1 NO	OVER SPEED ANN		

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
12	$\frac{42}{T4}$ SLEW TACHO RELAY	1NO	ACTUATING $\frac{42X}{T4}$	N12	
13	$\frac{42X}{T4}$ AUX-DO-	1NO 1NO 1NC	CS HOLD ON TACHO ON LAMP OVER SPEED ANN	ACP	OHS SIEMENS CONTACTOR
14	$\frac{42}{T5}$ COMMON CLUTCH PROTECTION RELAY	1NO	IN SERIES WITH $42/T1$	SS	ITI RELAY
15	DIFFERENTIAL SYNCHRO RELAY DSR	1NO 1NO 1NO 1NC 1NC	CS CIRCUIT DSR LAMP ON RESET LAMP TRIP LAMP MISALIGNMENT SYNCHRO ANN	SRH2	
16	MISALIGNMENT LOOPS RELAYS				
(i)	MAR-2	1NO 2NOs 1NC	CONTROL SUPPLY CIRCUIT MAR-1 LAMP ON MISALIGNMENT LOOP ANNUNCIATION	ACP	I-T-I RELAY

# RELAY & CONTACTORS

60

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
(ii)	MAR-2	1NO	CS CCT		
		2NOS	MAR-2 LAMP	ACP	I.T.I RELAY
17		1NC	MA-LOOP - ANN		
	LATCH RELAY	1NC	FOR $\frac{42}{\text{TRACK}}$	SR#1	
	<u>R</u> LATCH	1NC	FOR $\frac{2}{\text{BR}}$		
18	TACHO RELAY FOR SERVO SYSTEM				
	<u>R</u> TACHO	1NO	ACTUATING <u>Rx</u> TACHO	SR#1	SIGMA RELAY
19	AUXILIARY TACHO RELAY FOR SERVO SYSTEM				
	<u>Rx</u> TACHO	1NO	$\frac{42}{\text{BR}}$	SR#1	SIZE 1/H5
		1NO	$\frac{2}{\text{BR}}$		LBO-K915
20	CLUTCH RELAYS CLUTCH CURRENT				
	<u>R/CL-3</u> RELAY C.C	1NO	FOR $\frac{x}{\text{BR}}$ HOLD ON		BARC
(i)		1NC	CLUTCH CURRENT FAILURE ANN	ACP	RELAY
(ii)	<u>R/CL-4/2</u>				
	1- TRACK CLUTCH	1NO	$\frac{x}{\text{BR}}$ HOLD ON	ACP	BARC
	2- SCAN CLUTCH	1NO	CLUTCH CURRENT FAILURE ANN		RELAY

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	BRAKE RELAYS TIME DELAY RELAY FOR BRAKES $\frac{2}{BR}$	1NO INST NC  1NO TDDO	TO ACTUATE  $\frac{X}{BR}$	MCC	CUTLER HAMMER TIME DELAY RELAY
2	AUXILIARY BRAKE CONTACTOR  $\frac{X}{BR}$	1NO 1NO 1NO 1NO 1NO 1NO	SLM CCT SCM CCT TRACK CCT.(MAINS) TRACK LAMP(MAINS) SERVO CCT ANN MOTOR TRIP	MCC	MV 1 CONTACTOR
3	MAIN BRAKE POWER CONTACTOR 42/BR	3NOS 1NO 1NO 1NO 1NO 1NO	FOR POWER TO BRAKES SLM HOLD-ON SCM HOLD-ON CLUTCH CURRENT FAILURE ANN BRAKE FAILURE ANN MOTOR TRIP ANN	MCC	SIEMENS SIZE III CONTACTOR
4	$\frac{X1}{BR}$ 2 $\frac{X2}{BR}$ AUX BRAKE RELAYS N12-N1 2 S12-S1	1NO 1NO 1NC 1NC	FOR $\frac{X}{BR}$ FOR EAST/WEST LAMP ANN BRAKE FAILURE 42-TB/TDDO	ACP	I-T-I RELAY

# THERMAL RELAYS

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	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	THERMAL RELAYS FOR SLEWING MOTOR 49/SLM 1, 2, 3, 4	1NC	<u>49X</u> SLM		
2	<u>49X</u> SLM AUXILIARY THERMAL RELAYS FOR SLEWING MOTOR	1NO 1NO 1NC	FOR SLM CIRCUIT 42/BR MOTOR TRIP ANN		
3	THERMAL RELAY FOR SCANNING MOTOR 49/SCM	1NC	TO ACTUATE <u>49X</u> SCM		
4	AUXILIARY THERMAL RELAY SCANNING MOTOR <u>49X</u> SCM	1NO 1NO 1NC	SCM CIRCUIT 42/BR MOTOR TRIP ANN		
5	THERMAL RELAY FOR SYNCHRONOUS TRACKING MOTOR 49/SYM	1NC	TO ACTUATE 49X/SYM		
6	49X/SYM	1NO 1NO 1NC 1NO 1NO	42/BR TRACK MAINS MOTOR TRIP ANNUNCIATION SERVO (TKM) SERVO STARTING CIRCUITS		

# UNDER CURRENT RELAYS

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
<u>UNDER CURRENT RELAYS</u>					
1	SLM CURRENT SENSING <u>37A, B, C</u> SLM 1, 2, 3, 4	3NOS	To ACTUATE <u>37X</u> SLM	MCC	ENGLISH ELECTRIC
2	<u>37X</u> AUXILIARY SLM SLEWING MOTOR CURRENT SENSING	1NO	42/BR	MCC	<u>LBO</u> K915 <u>SIZE</u> 1H5
		1NO	SLEW LAMP		
		1NO	MOTOR TRIP ANN		
	SCM CURRENT SENSING 37ABC / SCM	3NOS	To ACTUATE 37X / SCM	MCC	ENGLISH ELECTRIC
4	AUXILIARY SCANNING CURRENT SENSING <u>37X</u> SCM	1NO	42/BR	MCC	<u>LBO</u> K915 <u>SIZE</u> 1H5
		1NO	SCM LAMP		
		1NC	MOTOR TRIP ANN		
6	<u>37 ABC</u> SYM	3NOS	To ACTUATE 37X / SYM	RELAY CABINET	ENGLISH ELECTRIC
		1NO	HOLD-ON SERVO TRM-1	RELAY CABINET	
		1NO	HOLD-ON SERVO TRM-2		
		1NO	42/BR		
		1NO	TRACK LAMP		
1NC	MOTOR TRIP ANN				

# MOTOR CONTACTORS

13  
64

SL NO	FUNCTION NAME	CONTACTS USED	DETAILS	LOCATION	REMARKS
1	MOTOR CONTACTORS <u>42X</u> SLM-E SLEWING MOTOR EAST AUXILIARY CONTACTOR	1NO	FOR 42/SLM-1 (E)		
		1NO	42/SLM-2 (E)		
		1NO	42/SLM-3 (E)		
		1NO	42/SLM-4 (E)		
		1NO	42X/SLM-E HOLD ON		
		1NO	X/BR		
		1NO	2/BR		
		1NO	SLEW LAMP		
		1NO	EAST LAMP		
		1NO	MOTOR TRIP ANN		
		1NC	SCM INTERLOCK		
		1NC	TRACK MAINS		
		1NC	SERVO		
2	<u>42X</u> SLM-W SLEWING MOTOR WEST AUXILIARY CONTACTOR	1NO	FOR 42/SLM-1 (W)		
		1NO	42/SLM-2 (W)		
		1NO	42/SLM-3 (W)		
		1NO	42/SLM-4 (W)		
		1NO	X/BR		
		1NO	2/BR		
		1NO	SLEW LAMP		
		1NO	WEST LAMP		
		1NO			
		1NO			

ORT CONTROL CABLES

SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
1	C 201 5 CORE CABLE	S12	N12	R Y B	CONNECTING STATORS OF DIFFERENTIAL SYNCHROS TRANSMITTER AND TRANSFORMER
2	C 202 12 CORE CABLE	N12	MJB	2 CORE PH NE 232 233 234 235 238 239 242 243 SPARE	PHASE AND NEUTRAL TACHO SUPPLY TACHO RELAY 42/T4 (N12) CONTACT DIFFERENTIAL SYNCHRO TRANSFORMER OUTPUT TERMINALS MA-1 +VE WIRE MA-1 -VE WIRE N12 END MA-2 +VE WIRE MA-2 -VE WIRE N12 END USED FOR INITIAL BYPASS OF TACHO UNDERVOLTAGE TRANSISTOR (42X/TB-TDDO)
3	C 202 X 12 CORE	MJB	SS	230 231 236 237	S12 TACHO RELAY CONTACT



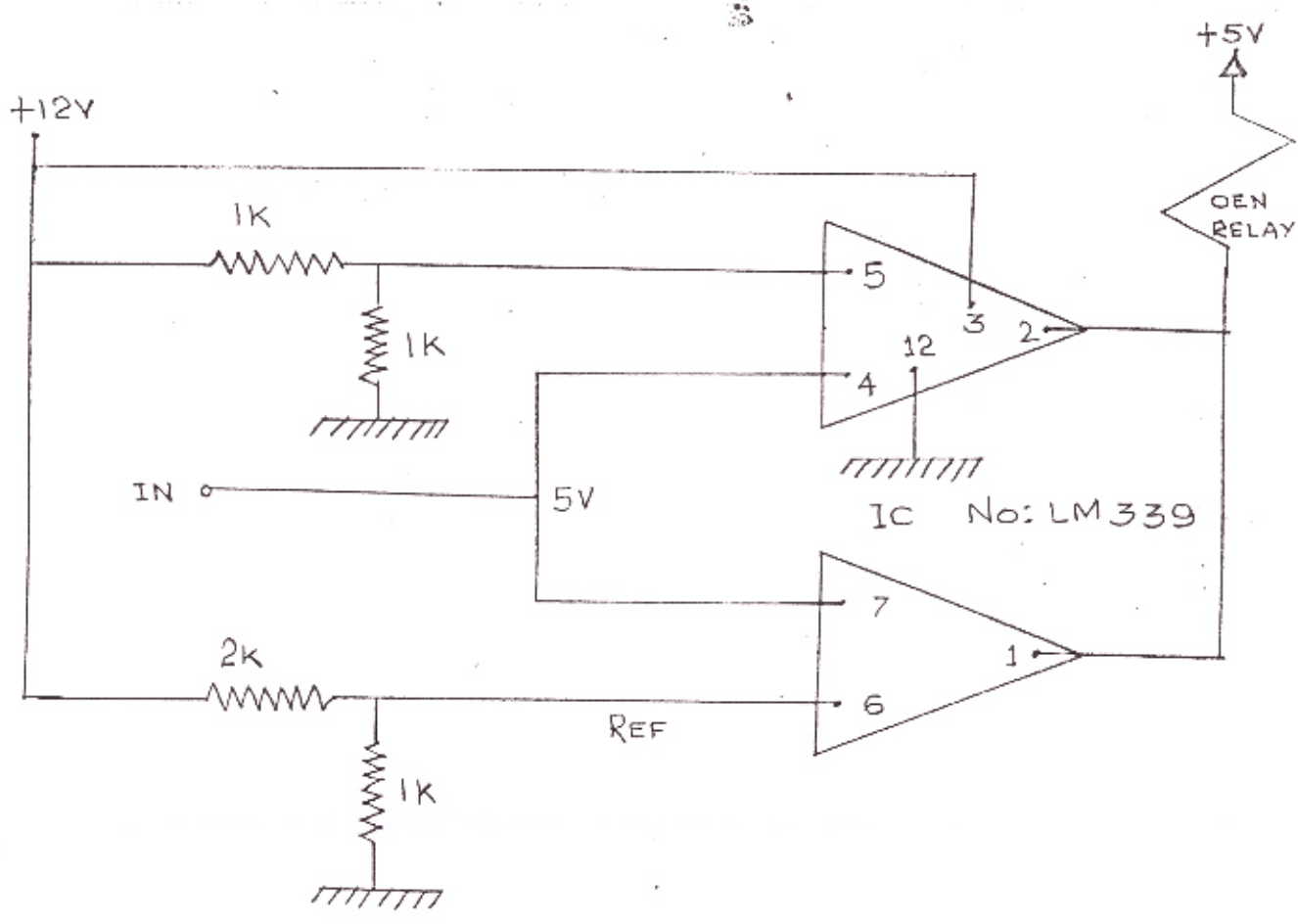
SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
15	C 218 6 CORE	ACP	MCC	200	TRACK MAINS LAMP. PHASE  X/BR HOLD ON  X/BR FOR MOTOR TRIP ANNUNCIATION
				201	
				202	
				203	
				204	
205					
16	C 218A 2 CORE	MCC	RELAY CABINET	201	42-SYM/MAINS (NO) FOR TRACK MAIN LAMP
				200A	
17	C 219 6 CORE	ACP	RELAY CABINET	246	START 43X-SYM/MAINS & SERVO CONTACT 43X-SYM/MAINS & SERVO  -DO-
				247	
				248	
				249	
				250	
251					
18	C 223 6 CORE	SRH1	RELAY CABINET	349	FOR 42/TRM-1 42X-TRACK/TDPU 42X-TRACK/TDDO
				350	

SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
				336 } 337 }	42-SYM MAINS
				338 } 339 }	- DO -
				340 } 341 }	- DO -
13	C 216 6 CORE	RELAY CABINET	ACP	252 253 } 254 }	ANNUNCIATION PHASE (-12V) MOTOR TRIP ANNUNCIATION 49X/TRACK
				255	37X/SYM (NO)
				256	35
				257	NEUTRAL
14	C 216 6 CORE	SR#1 CABINET	RELAY	317 } 318 }	37X/SYM (NO)
				319 } 320 }	37X/SYM TRACK LAMP (NO)
				321 } 322 }	37X/SYM (NO) FOR 42/BR

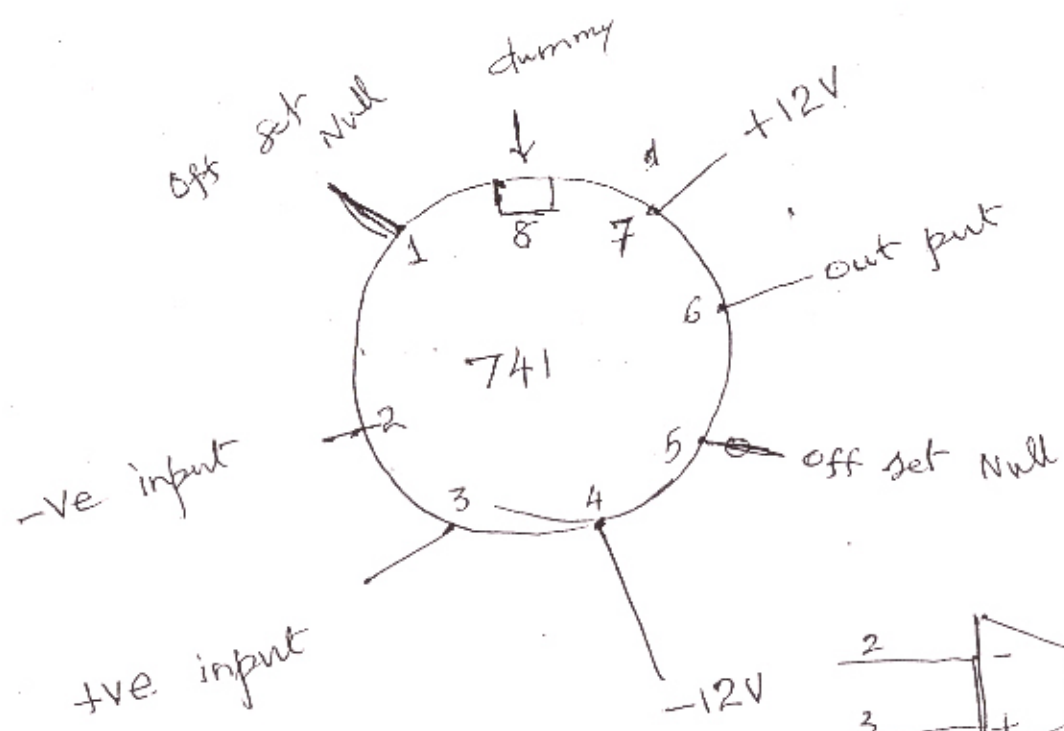
SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
				351 } 352 } 353 } 354 }	FOR 42/TRM-2, 42X TRK/TDPU 42X TRACK/TDDO 42-TRACK/TDPU
19	C 224 6 CORE	SR#2	RELAY CABINET	342 } 343 } 344 } 345 } 346 } 347 }	PHASE NEUTRAL POWER TO STARTING CIRCUITS 42-SYM/MAINS 43X SYM/MAINS-SERVO 49X/TRACK
20	C 225 2 CORE	RELAY CABINET	SR#1	R NE	THROUGH 43X-SYM/MAIN-SERVO POWER TO SR#1
21	C 226	ACP	SR#1	258 259	WAIT A MINUTE CONTROL PB-STOP/SERVO

SL No	CABLE TITLE	FROM	TO	CORE NO	DETAILS
22	C 227 6 CORE	MCC	ACP	206 208 210 209 211 300A	MOTOR TRIP ANN PB-START/TRACK FOR BRAKE FAILURE ANNUNCIATION ANNUNCIATION PHASE BRAKE FAILURE ANNUNCIATION CLUTCH FAILURE ANNUNCIATION IL-DS/ON
23	C 228 6 CORE	SR#1	MCC	214 215 216 217 218 219	42/TRACK FOR CLUTCH FAILURE ANNUNCIATION BRAKE FAILURE ANNUNCIATION INTERLOCK OF SLEW, SCAN, WEST LIMIT, END LIMIT FOR TKM PANEL
24	C 229 2 CORE	SR#1	SR#2	218 219	NEUTRAL FOR 42-SYM/SERVO THROUGH 49X/TRACK

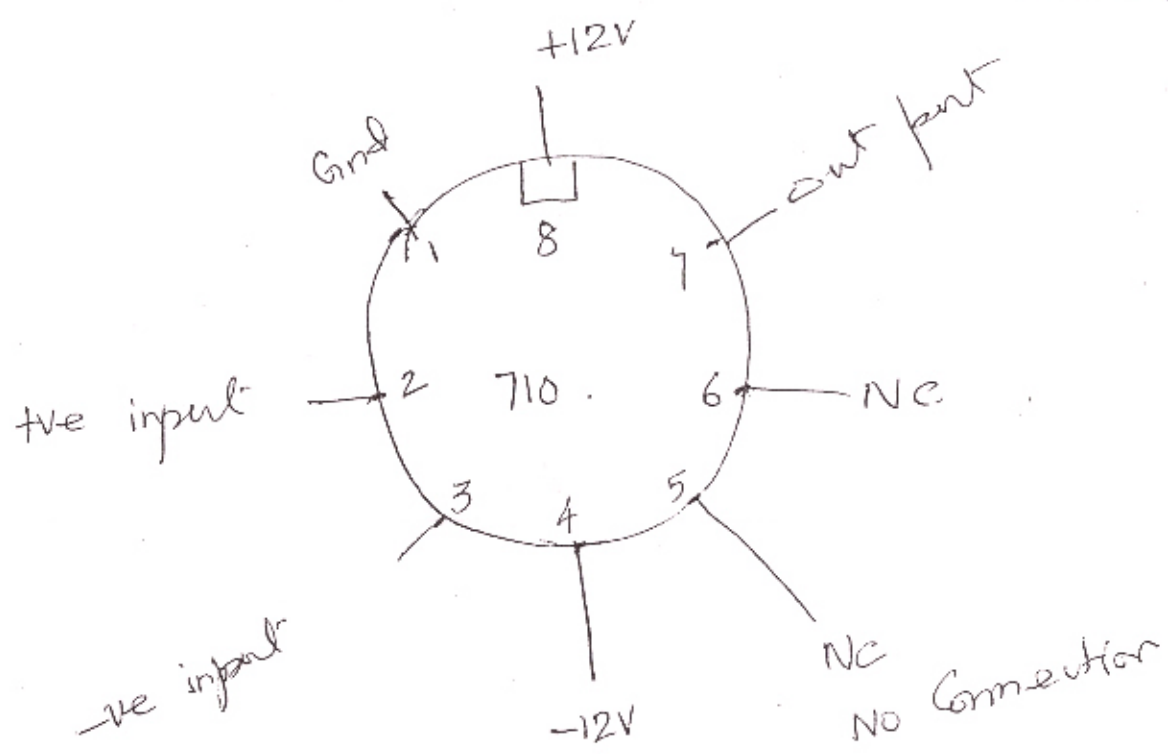
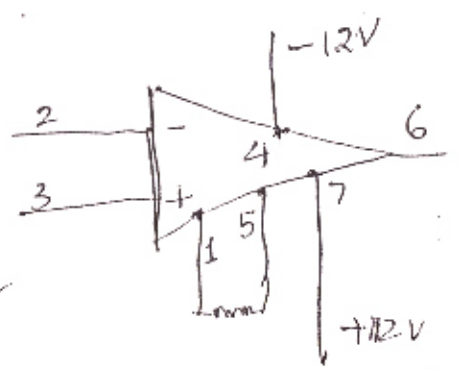
SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
25	C 230 4 CORE	MCB	MCC	220 221 222 223	PHASE 20 42X1/T1 TACHO PHASE SUPPLY NEUTRAL
26	C 231 6 CORE	SJB	MJB	1) 14E 2) 17 228 229 361 362	4E USED FOR ANNUNCIATION 7 OF TACHO LAMPS  OVER SPEED ANNUNCIATION  OVER SPEED ANNUNCIATION
27	C 232	SJB	MJB	355 356 357 358 359 360	TACHO TEST  TACHO TEST  PHASE 42-TB/TDDO



SL NO	CABLE TITLE	FROM	TO	CORE NO	DETAILS
	C233 4 CORE	MJB	ACP	361 362 363 364	OVER SPEED ANNUNCIATION COMMON CLUTCH TACHO CONTACT ANNUNCIATION PHASE
29	C 234	ACP	RELAY CABINET	229 362	42-SYM / MAINS OVER SPEED ANNUNCIATION



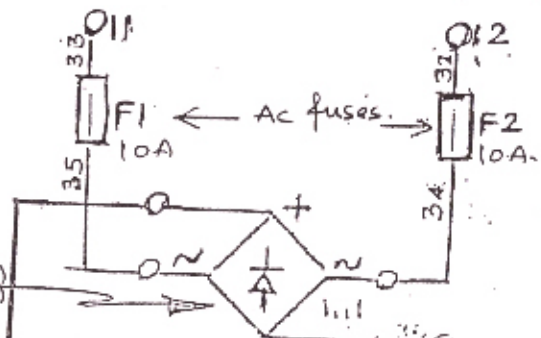
DC amplifier



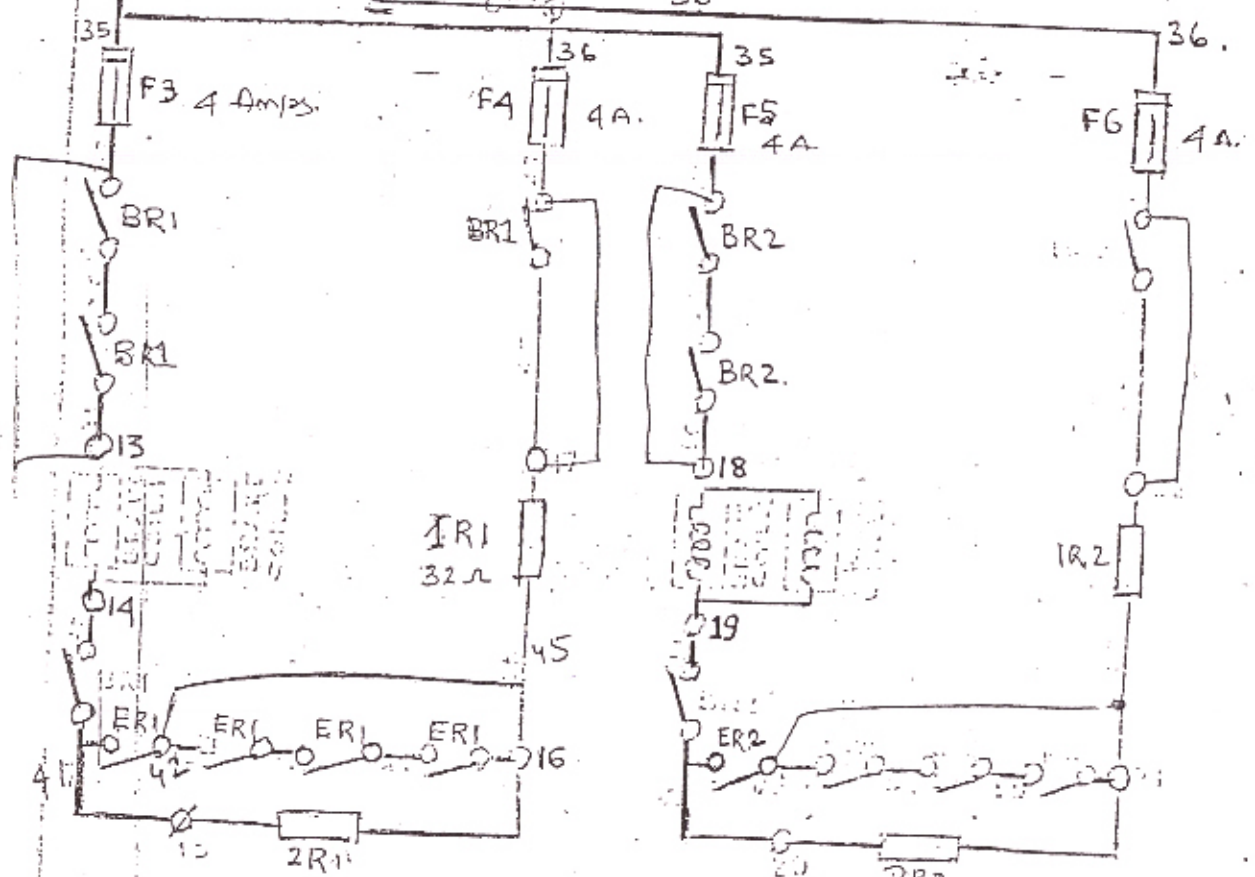
Comparator

EXISTING AC BRAKE supply  
 ← 415V, 50HZ →

Usha Rectifier  
 R183DISBBD.



WINDING No.	CONTROL VOLTAGE	COIL W. CODE
AFBE-845-4	110V AC	F.A.
AFBE-845-5	220V AC	F.B.
AFBE-845-6	415V AC	F.C.
AFBE-845-4	415V AC	M



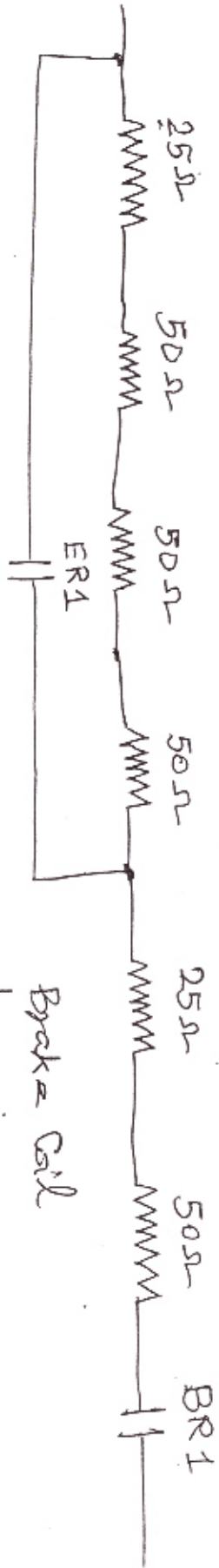
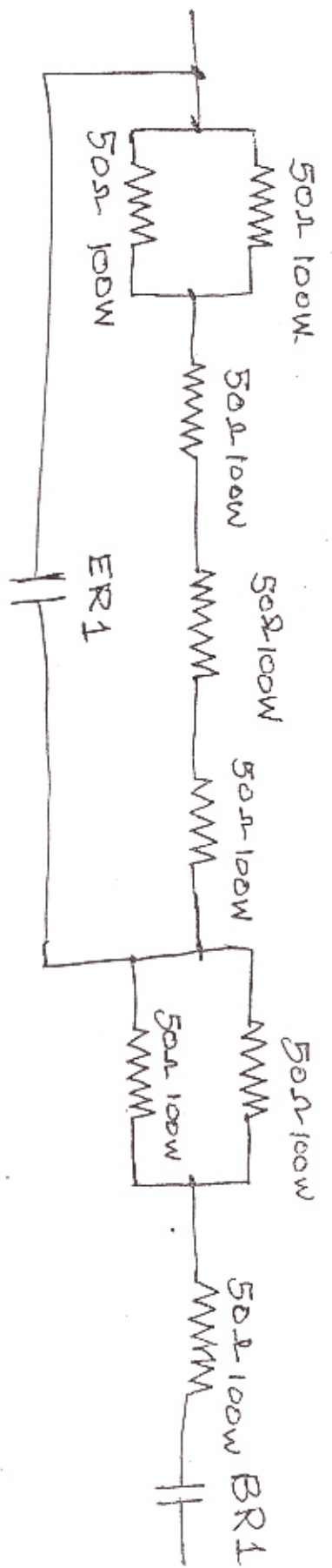
$80 + 52 + 42 \Omega$   
 (= 174)

Total no of fuses: 7 nos.

Total 5 Relays

- ER - Economic Relay
- BR - Brake Relay
- TR - Time delay Relay





M. J. Dy

SA1 ELECTRICAL

ENGS. WORKS P.LTD

Ston Barrow - 4500 022.

Phone 484667

0V

810V

220V

230V

230V

Transformer

Primary V 210, 220, 220

230V

230V

230V

410

400V

390V

250V

230V

420V

810V

230V

230V

230V

9150

9150

9150

9150

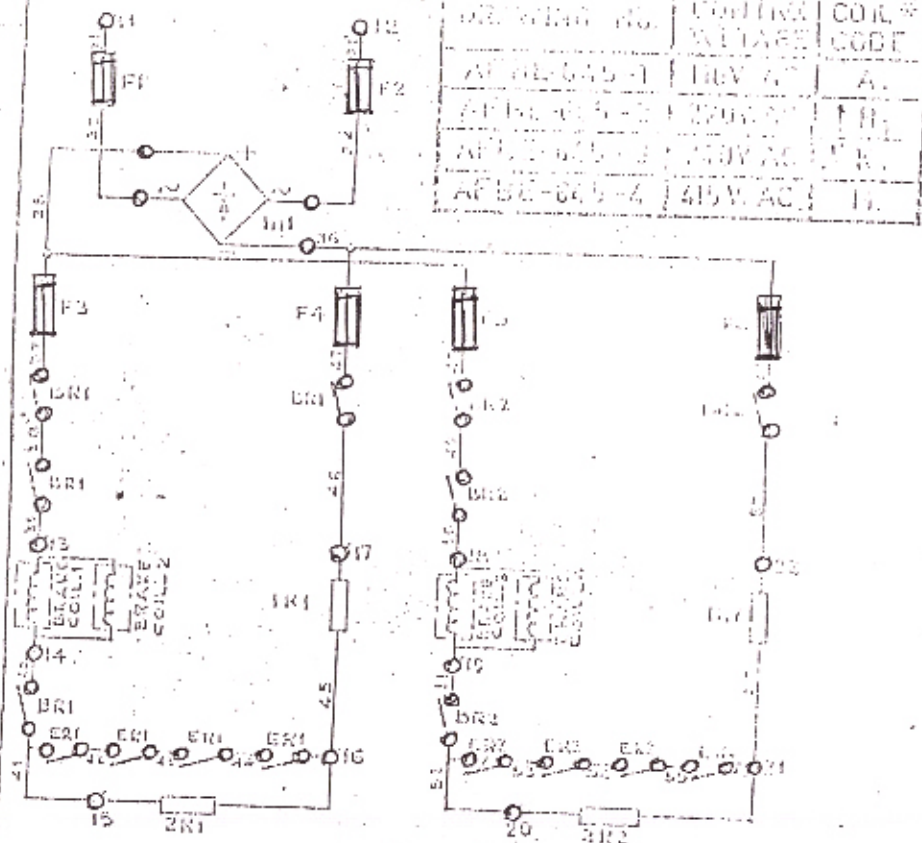
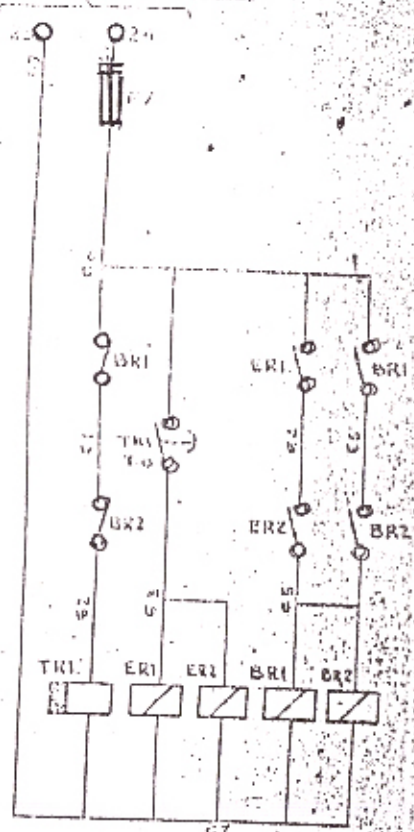
9150

415V, 50HZ.

TABLE No.1

DR. WINDG. NO.	CONDUCTING VOLTAGE	COR. CODE
AF 64-645-1	110V AC	A.
AF 64-645-2	220V AC	B.
AF 64-645-3	440V AC	C.
AF 64-645-4	415V AC	D.

PCB TABLE No.1



SCH.	DESCRIPTION	MAKE	TYPE	QTY.
ER1, ER2, BR1, BR2	CONTACTORS	B.C.H	NIN-4001CB11	2A, 2
TR1	OFF. DELAY TIMER	"	RTPN 10+1	1
M1	RECTIFIER	USHA/IRI/EQU.	SEE TABLE	2
F1-F7	H.R.C FUSE LINK @ AMPS	E.E	NS15H+NS @	7
IR1, IR2, 2R1, 2R2	RESISTORS (200W)			2, SET

ITEM	BRAKE SIZE		USHA RECTIFIER CODE NO.	RESISTOR @		FUSE LINK @ AMP.		
	INCH	MM		IR1 / IR2	2R1 / 2R2	F1, F2	F3, F4, F5, F6	F7
1	8	200	D18D1SDBKD	32Ω — 32Ω	112Ω — 80Ω — 42Ω	6	2	2
2	10	250	R18D1SDBKD	32Ω — 32Ω	80Ω — 32Ω — 42Ω	10	4	2
3	13	300	P18D1SDBKD	32Ω — 32Ω	40Ω — 40Ω	10	4	2
4	16	400	P18D1SDBKD	80Ω — 80Ω	112Ω — 32Ω — 112Ω — 32Ω	15	6	2
5	19	500	J18D1SDBKD	80Ω — 52Ω	80Ω — 42Ω — 80Ω — 42Ω	15	6	2
6	23	600	F18D1SDBKD	40Ω — 40Ω	112Ω — 32Ω — 112Ω — 32Ω — 112Ω — 32Ω	20	10	2

CIRCUIT DIAGRAM FOR BRAKE CONTROL PANEL

DRAWN: *[Signature]* 17.6.78 APPROVED: *[Signature]*

CHECKED: *[Signature]* REP. NO. FIRST ASSY. WHERE USED

NO. OF SHEETS: 1 SHEET NO: 1

ORG. NO: FBE-645

DO NOT SCALE DRAWING. WORK ACCORDING TO DIMENSIONS.

SCALE: DIMS. IN INCHES/10 THIRD ANGLE PROJECTION

CUTLER-HAMMER INDIA LTD. FARIDABAD II (HARYANA)

ADD. TABLE R2  
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 10-9-78

Identification of wires for various circuits.

(1) undervoltage circuits.

located in MCC.  $\frac{27}{AB}$  &  $\frac{27}{BC}$  Contacts for  
Control Supply are 17 and a terminal of  $\frac{42}{CS}$ .

(2) Overvoltage protection in series with the above contact  
17 & 17A

(3) Overspeed Tachs circuits.

T Tacho Supply Selector Switch in MCC.

FP  $\frac{42}{T_1}$  — Scan/Track relay  
 $\frac{42}{T_2}$  — Slew relay  
 $\frac{42}{T_5}$  — Common clutch protection tachs relay } SS  
 $\frac{42}{T_4}$  — N12 tachs relay  
 $\frac{42}{T_3}$  — S12 tachs relay

II Slew {  $\frac{42}{T_2}$  Contact — 12 & 12A. for Control Supply  
 $\frac{42}{T_3}$  Contact — 230 & 231 to actuate  $\frac{42X}{T_3}$   
 $\frac{42}{T_4}$  Contact — 232 & 233 to actuate  $\frac{42X}{T_4}$

IV  $\frac{42}{T_1}$  Scan/Track  $\frac{42}{T_1}$  to actuate  $\frac{42X}{T_1}$

$\frac{42X}{T_1}$  1 NO to actuate  $\frac{42X_1}{T_1}$  in MCC.

1 NC to alarm circuit.

2 Common stop Fan. 230.

$\frac{42}{T5}$  Contact connected in series with  $\frac{42}{T1}$  Contact.

(4) Misalignment loop system.

MA-1 (East)

(N<sub>12</sub>)<sup>end</sup> 238 to 240 (S<sub>12</sub>)<sup>end</sup> +ve wire.  
(N<sub>12</sub>) 239 to 241 (S<sub>12</sub>) -ve wire.  
240 B to 306 MA relay - 1

MA-2 (West)

(N<sub>12</sub>) 242 to 244 (S<sub>12</sub>) +ve wire  
N<sub>12</sub> 243 to 245 (S<sub>12</sub>) -ve wire  
309 to 244 B MA relay - 2.

Control Supply Contacts. 14, 14A & 14A 3/4 B.  
(1) (2)

(5) Differential Synchro circuit.

237, 238 50 volts input to S<sub>12</sub> Transmitter.  
234, 235 Synchro Transformer output from N<sub>12</sub> 2/11/76 to DSR circuit.

DSR Contact to Control Supply is 14 B & 14 C.

DS/co Contact is 14 C & 14 D

(6) MASTER/co Contact is 14 D & 14 E.

Emergency PB and crush type Emergency limit switches are from 12 to 16.

II Limit Switch Circuit.

(i) East.

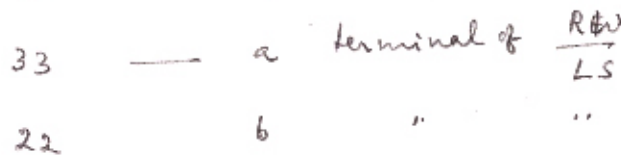
Ph. 20 → N<sub>1</sub> East limit switches on North and South → 32.  
32 to S<sub>1</sub> South and return to N<sub>1</sub> as 31.



$\frac{PB-LS-E}{BYPASS}$  points are 31 and 34A.

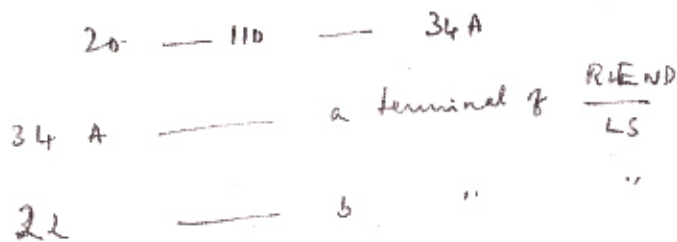
(ii) WEST

20 — West limit switches on North and South — 34.  
goes to S<sub>1</sub> and returns as 33 to N<sub>1</sub> to



$\frac{PB-LS-W}{BYPASS}$  are 33 and 110.

End.



Thermal relays:

- 1) SLM circuit. 49X/SLM.
- |          |            |               |       |
|----------|------------|---------------|-------|
| 20 - 72  | 49 / SLM-1 | Bypass points | 20-72 |
| 72 - 71  | 49 / SLM-2 | "             | 72-71 |
| 71 - 70  | 49 / SLM-3 |               |       |
| 70 - 38A | 49 / SLM-4 |               |       |

2) 20 & 20A 49 / scm.

3) 20 and 20B 49 / TRACK.

Under current relays:

- 1) SLM circuit.
- |          |   |     |                             |                                     |
|----------|---|-----|-----------------------------|-------------------------------------|
| 35 - 52A | + | 51  | <u>37, A, B, C</u><br>SLM-1 |                                     |
| 51 to    |   | 50  | <u>37A, B, C</u><br>scm-2   |                                     |
| 50 to    |   | 49  | <u>37A, B, C</u><br>SLM-3   | 48A down line<br>for<br>37X<br>SLM. |
| 49 to    |   | 48A | <u>37A, B, C</u><br>SLM-4   |                                     |

2) SCM circuit. 35 to 35A 37A, B, C  
scm

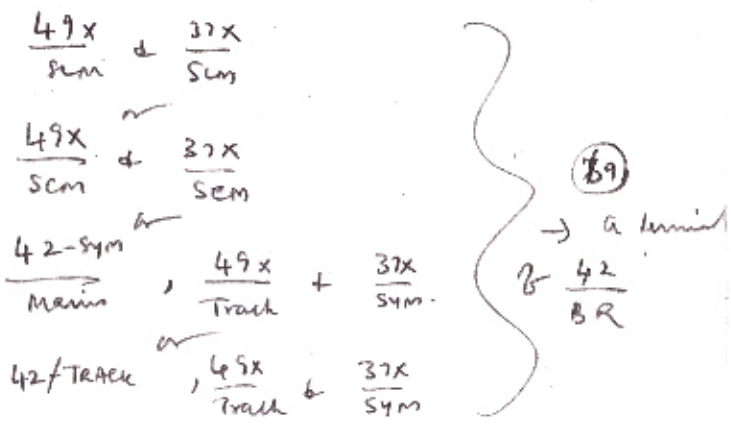
35A + ne  
for  
37X  
scm.

3) SYM circuit. 256 and 257 37A, B, C  
SYM

257  
+ ne for  
37X  
SYM.

Brakes:

- i)  $\frac{68A}{BR}$  &  $68$  to  $2/BR$  a terminal.
- ii)  $\frac{79}{79A}$  via  $2/BR$  TD contact to  $\frac{X}{BR}$  a terminal 79.  
in 35 through  $X1/BR$  &  $X2/BR$ .
- iii)  $\frac{X1}{BR}$  relay is through 73, 74, 75 (North)
- iv)  $\frac{X2}{BR}$  relay is through 76, 77, 78
- v)  $\frac{42}{BR}$  is 69.  
35 through



Clutches:

- i) Scan clutch :  $84$  &  $83$   
Track clutch :  $82$  &  $83$   
Scan/Track clutch relay :  $81A$  &  $81B$ .
- ii) Common clutch :  $80$  &  $83$   
Common clutch relay :  $81A$  and  $81B$ .

ORT Control cables Contd.

Sl No	Cable H/W	From	To	Core no	Details.				
12.	C 215 A B	Relay Cabinet	SR#1	324 } 325 }	49X / TRACK				
				326 } 254 }	Motor trip Ann.				
				Spare Spare					
				327 } 328 }	42-sym main				
				329 } 252 }	"				
				330A } 330 }	"				
				323 } 321 }	"				
				332 } 333 }	"				
				334 } 335 }	"				
				336 } 337 }	"				
				338 } 339 }	"				
				340 } 341 }	"				
				13.	C 216 6 core	Relay Cabinet	A.C.P.	252	Annunciation Phase (-12V)
								253 } 254 }	Motor trip Annunciation $\frac{49X}{Track}$
								255	37X/sym NO.
256	35								
257	Neutral.								
14	C 217 6 core	SR#1	Relay Cabinet	317 } 318 }	$\frac{37X}{SYM}$ NO.				
				319 } 320 }	$\frac{37X}{SYM}$ Track lamp. (NO)				
				321 } 322 }	$\frac{42}{BR}$ $\frac{37X}{SYM}$ NO for $\frac{42}{BR}$				



ORT Control Cables Contd

Sl no	Cable title	From	To	Cable no	Details.
22	C 227 6 core	MCC	ACP	206	Motor trip Ann.
				208	<u>PB-START</u> <u>TRACK</u> for Brake failure Ann.
				210	Annunciation phase.
				209	Brake failure Ann.
				211	Clutch failure Ann.
				300A	<u>IL-DS</u> <u>ON</u>
23	C 228 6 core	SR#1	MCC	214 } 215 }	<u>42</u> <u>TRACK</u> for clutch failure Ann.
				216 } 217 }	Brake failure Ann.
				218 } 219 }	Interlock of Slow, Scan West limit, end limit for TKM Panel.
				218 } 219 }	Neutral for <u>42-SYM</u> <u>SERVO</u>
					thro <u>49X</u> <u>TRACK</u> .
24	C 229 2 core	SR#1	SR#2	218 } 219 }	
				220	Ph 20
				221	<u>42X1</u> <u>T1</u>
				222	Tacho Ph. supply
25	C 230 4 core	MJB	MCC	223	NE.
				220	
				221	
				222	
26	C 231 6 core	SJB	MJB	1) 14E 2) 17	4E 7 used for Ann. of Tacho lamps.
				228	
				229	Overspeed Ann.
				361	
				362	..
27	C 232	SJB	MJB	355 356	Tacho Test.
				357 358	Tacho Test.
				359	
				360	Ph <u>42-TB</u> <u>TDDO</u> .