Supply

A

N

L N N I1 I2 I3 I4 I5 I6 I7 I8

AC 24V 8 Inputs
50/60 Hz

EATON

DEL ALT

EASY 512-AB-RC

ESC OK

4 outputs /8A

Q1 Q2 Q3 Q4

NO COM NC A N
(black) (white) (grey) (brown) (blue)

12-240 Vdc
24-240 Vac

Proximity Sensor 1

NO COM NC A N
(black) (white) (grey) (brown) (blue)

12-240 Vdc
24-240 Vac

Proximity Sensor 2

Limit Switch 1

Limit Switch 2

Start-Stop Station

START

NO pushbutton

STOP

NC pushbutton

1 3 5 A1

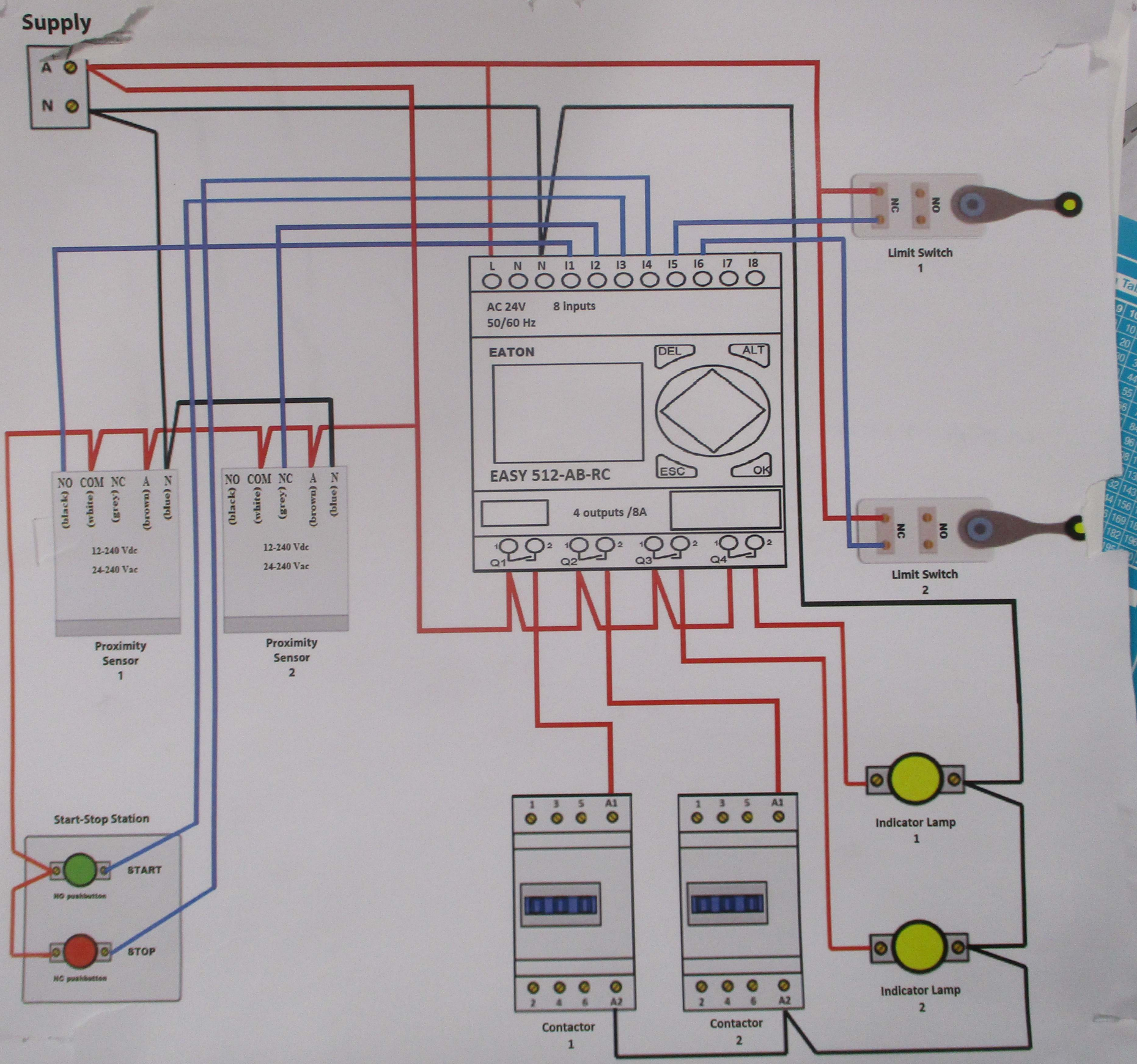
2 4 6 A2

Contactor 1

Contactor 2

Indicator Lamp 1

Indicator Lamp 2

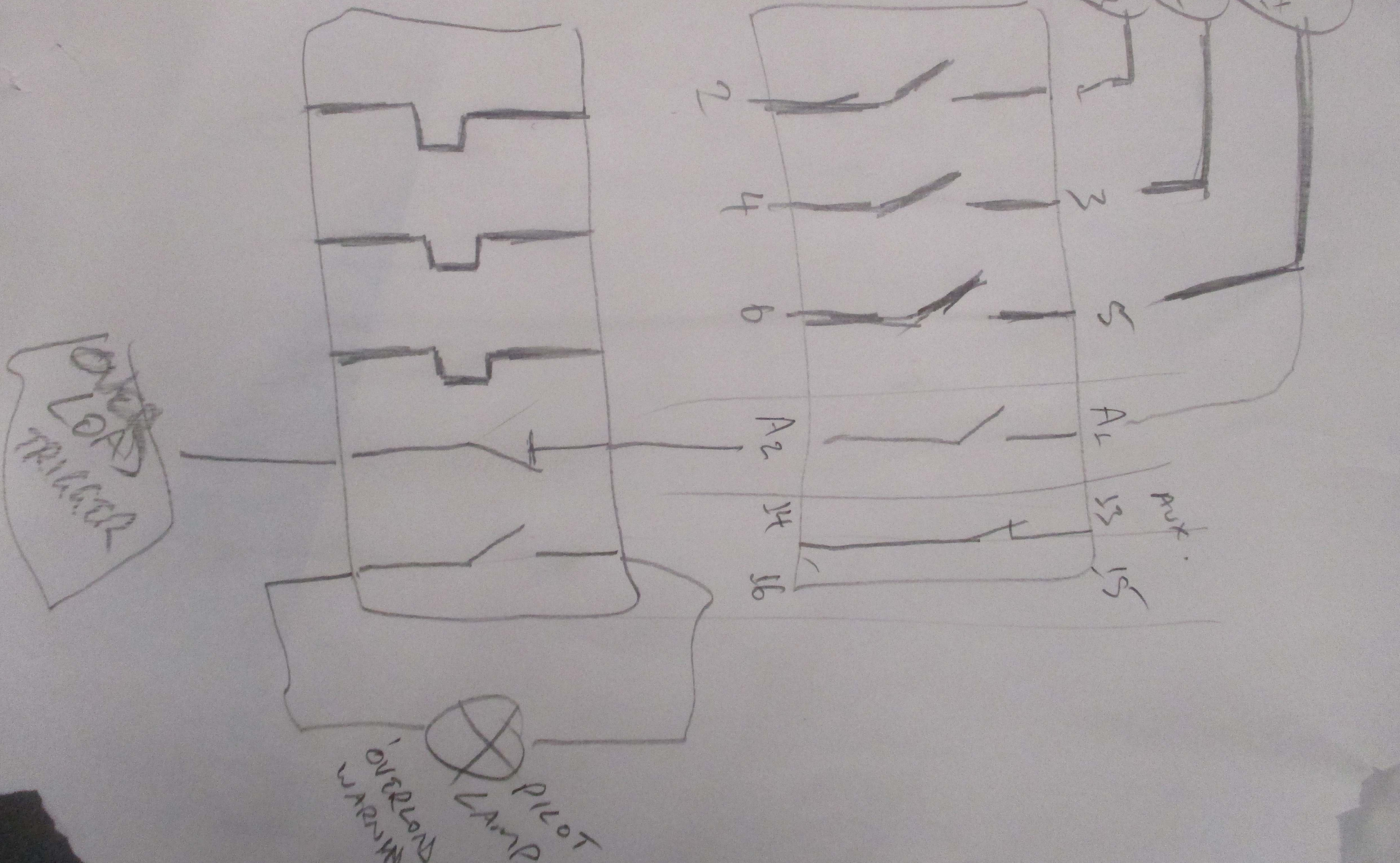

Supply
A
N
L N N I1 I2 I3 I4 I5 I6 I7 I8
AC 24V 8 Inputs
50/60 Hz
EATON
DEL
ALT
ESC
OK
EASY 512-AB-RC
4 outputs /8A
Q1
Q2
Q3
Q4
NO COM NC A N
(black) (white) (grey) (brown) (blue)
12-240 Vdc
24-240 Vac
Proximity Sensor 1
Proximity Sensor 2
NC
NO
Limit Switch 1
Limit Switch 2
Start-Stop Station
START
NO pushbutton
STOP
NC pushbutton
1 3 5 A1
2 4 6 A2
Contactor 1
Contactor 2
Indicator Lamp 1
Indicator Lamp 2

3φ ISOLATOR 20A —

NO

STAR

(STOP — LITTLE



11 — NO PROX 1 (BLACK) (4m CAR)

12 — NC PROX 2. (GREY) (STOP — LITTLE MAX)

13 — NO START BUTTON

14 — NC STOP BUTTON

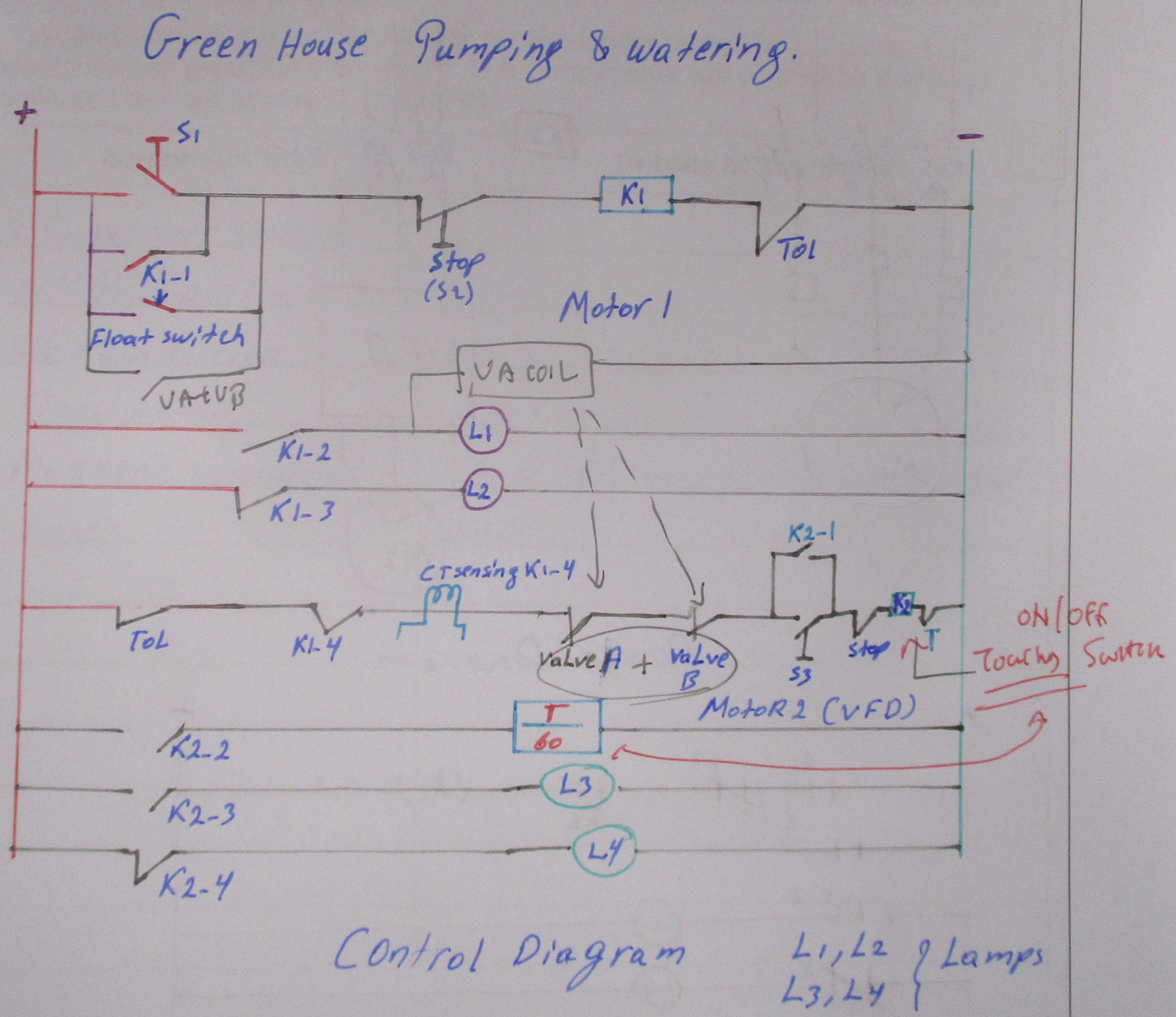
15 — NC LIMIT SWT — FULLY OPEN

16 — NC LIMIT SWT — FULLY CLOSED.

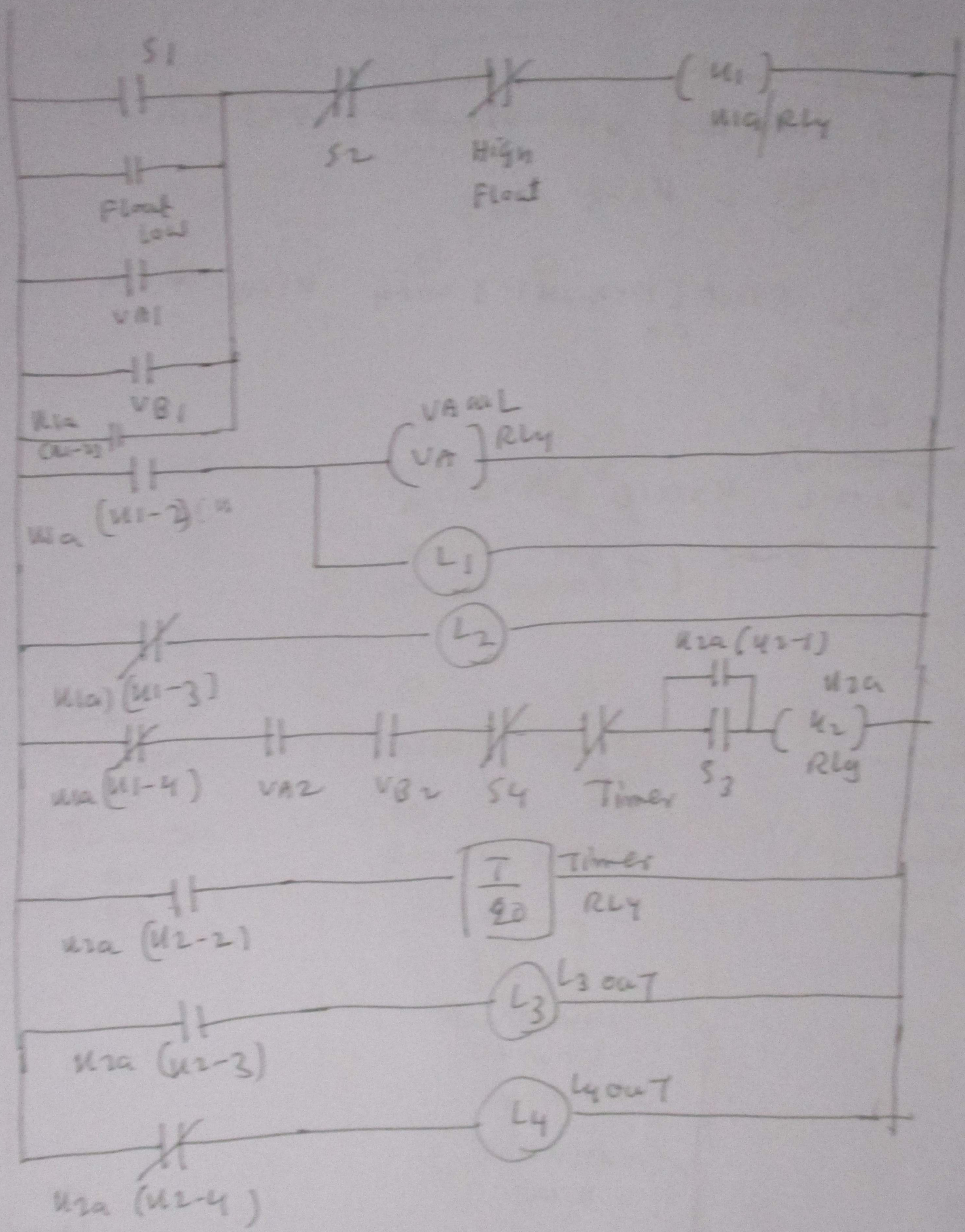
L6

Task B– Greenhouse Watering System

1. Develop your ladder diagram in the following space. Use correct drawing conventions, Australian Standard symbols. **(1 mark)**



LADDER DIAGRAM



PANEL

MOTOR(1)

PLC

MOTOR2

START STOP

S1 S2

FLOAT

LOW HIGH

START STOP

L1 L2

RUNNING STOPPING

VALVE VALVE

A1 B1

N/O N/O

<— FOR MOTOR 1 →

L3 L4

RUNNING STOPPING

K_1

CONTACTOR

K_1

(TO INSTALL

ON

DIN)

VALVE VALVE

A2 B2

N/O N/O

<— FOR MOTOR2 →

K_2

CONTACTOR

K_2

(TO INSTALL

ON

DIN)

VA

COIL

CONTROLLING

VA & VB

CONTACTORS

(TO INSTALL

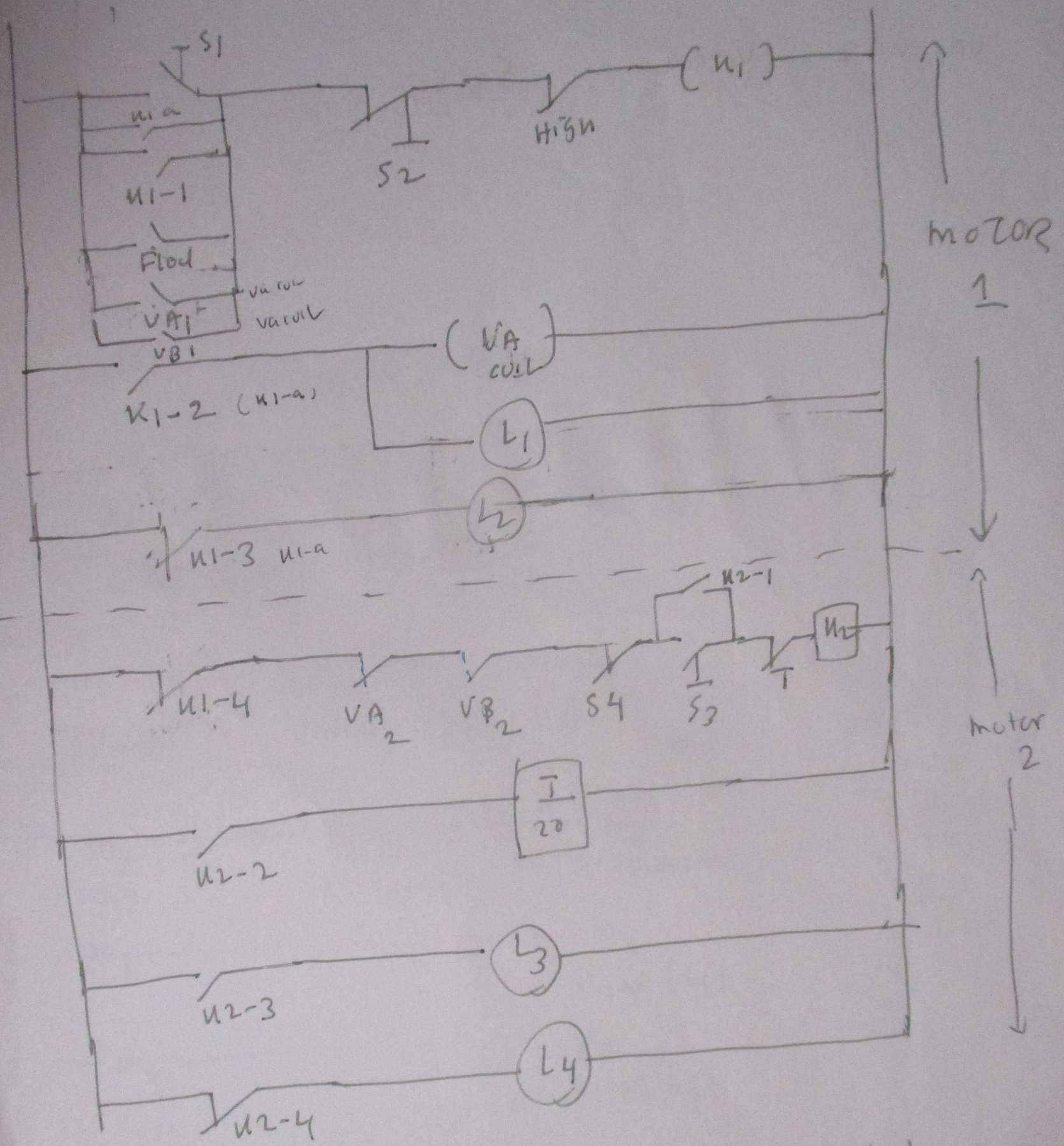
ON DIN

TIMER

MATERIALS

			QTY
①	Normally open Push button	(2x4)	8
②	Normally close Push button	(3x4)+1	13
③	Selector Switch	(1x4-3)	1
④	Signal light (Green) (ELV)	(2x4)	8
⑤	3ϕ circuit Breaker (C-63)	(1x4)	4
⑥	3ϕ circuit Breaker (C-50)	(2x4)	8
⑦	1ϕ circuit Breaker (C-63)	(1x4)	4
⑧	magnetic contactor MC 9B 24V AC Holding coil 3 poles + 1 Auxiliary Normally open	(2x4)	8
⑨	Coil MC32 3poles	(2x4) = 8-3	5
⑩	DIN RAIL	(40mm x 4)	160mm
⑪	Earth Link	(2x4)	8
⑫	3ϕ Isolator 20A	(2x4)	8
⑬	20mm PVC conduit	(70mm x 2x4)	560mm
⑭	20mm PVC male conduit bush	(4x4)	16
⑮	20mm PVC conduit mounting Saddle	(4x4)	16
⑯	20mm PVC flexible PVC conduit	(30mm x2x4) = 240mm	8 I E
⑰	20mm PVC conduit adapter	(4x4)	16

I_4 — I_4 — I_5 — M_1



K1 control

3 MAIN + 2 NO Aux
2 NC Aux

K1-1 (NO)
K1-2 (NO)
K1-3 (NC)
K1-4 (NC)

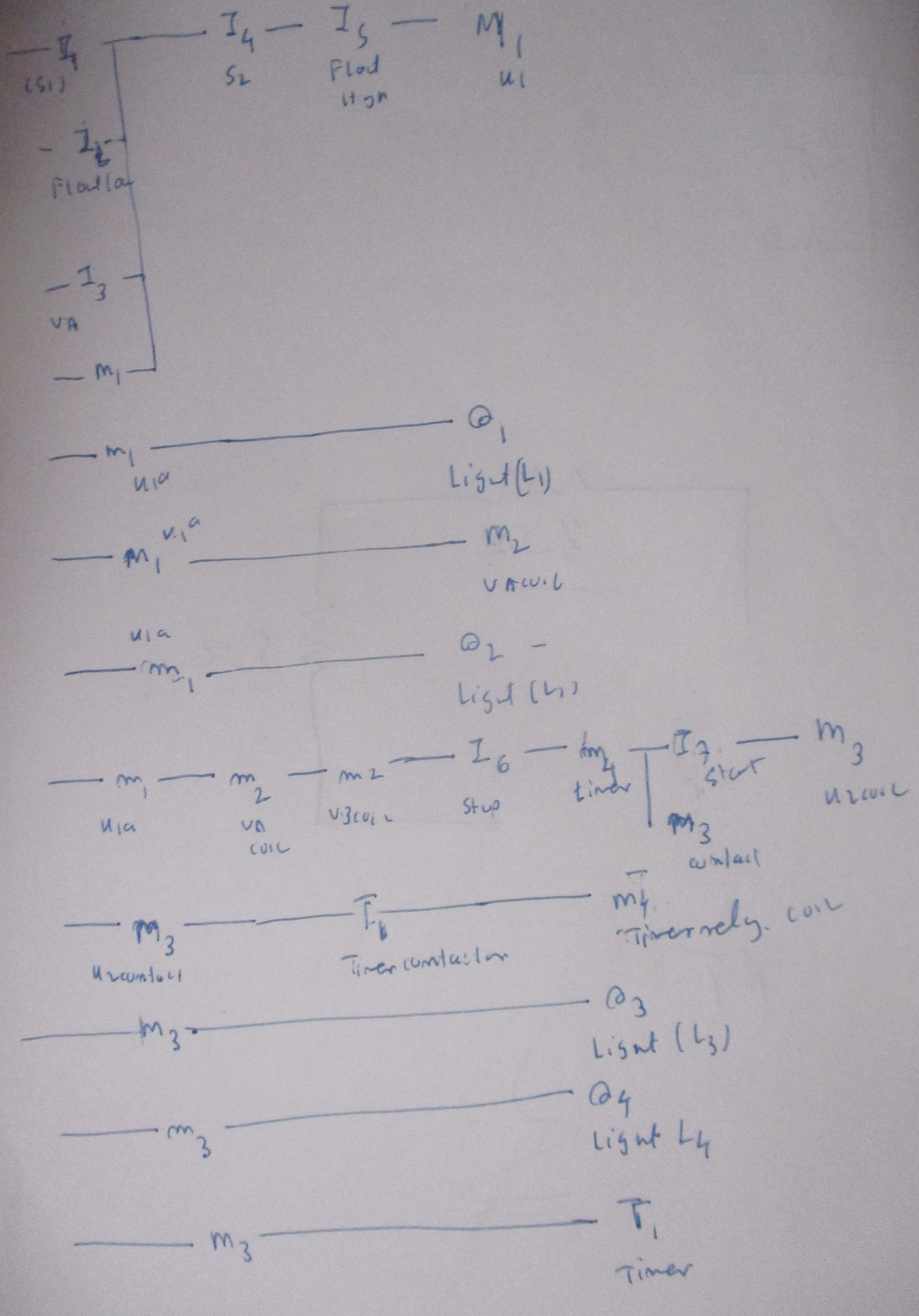
(It will need 2 contactors)

K2 control

3 MAIN + K2-1 (NO) Aux
K2-2 (NO) Aux
K23 (NO) Aux
K2-4 (NC)

(It will need 2 contactors)

VA control — VA1 (NO) VB1 (NO) Parallel to S1


I4
I5
M1
S2
Flod
I2
Flodla
I3
VA
m1
Q1
Light (L1)
m2
VA coil
Q2
Light (L2)
I6
Stop
I7
start
m3
m4
Timer rely. coil
T1
Timer
Q3
Light (L3)
Q4
Light L4

ELECTRICAL FUNDAMENTAL PRINCIPLES

CLASS TIMETABLE

Week	Topics	Wednesday 4:30 to 7:30PM	Thursday 4:30 to 7:30PM	Friday 4:30 to 7:30PM
1	DC Series Circuits Theory	√		√
2	DC Parallel Circuits Theory	√		√
3	Single Phase AC Circuits Theory	√		√
4	Three Phase AC Circuit Theory	√	DC and AC Circuit Practical Class	√
5	Electromagnetism Theory	√		√
6	Transformer Theory	√		√
7	DC Generator Theory	√		√
8	DC Motor Theory	√	Electromagnetism and DC Machines Practical	√
9	Three Phase AC Motor Theory	√		√
10	Single Phase AC Motor, Alternator and Synchronous Motor Theory	√		√
11	Motor Control Theory	√		√
12	Electrical Testing	√	AC Machines and Electrical Testing Practical	√

Resources

- Moodle
- Workbooks
- Class Tutorial Sheets

The students to bring

- Note book
- Scientific Calculator

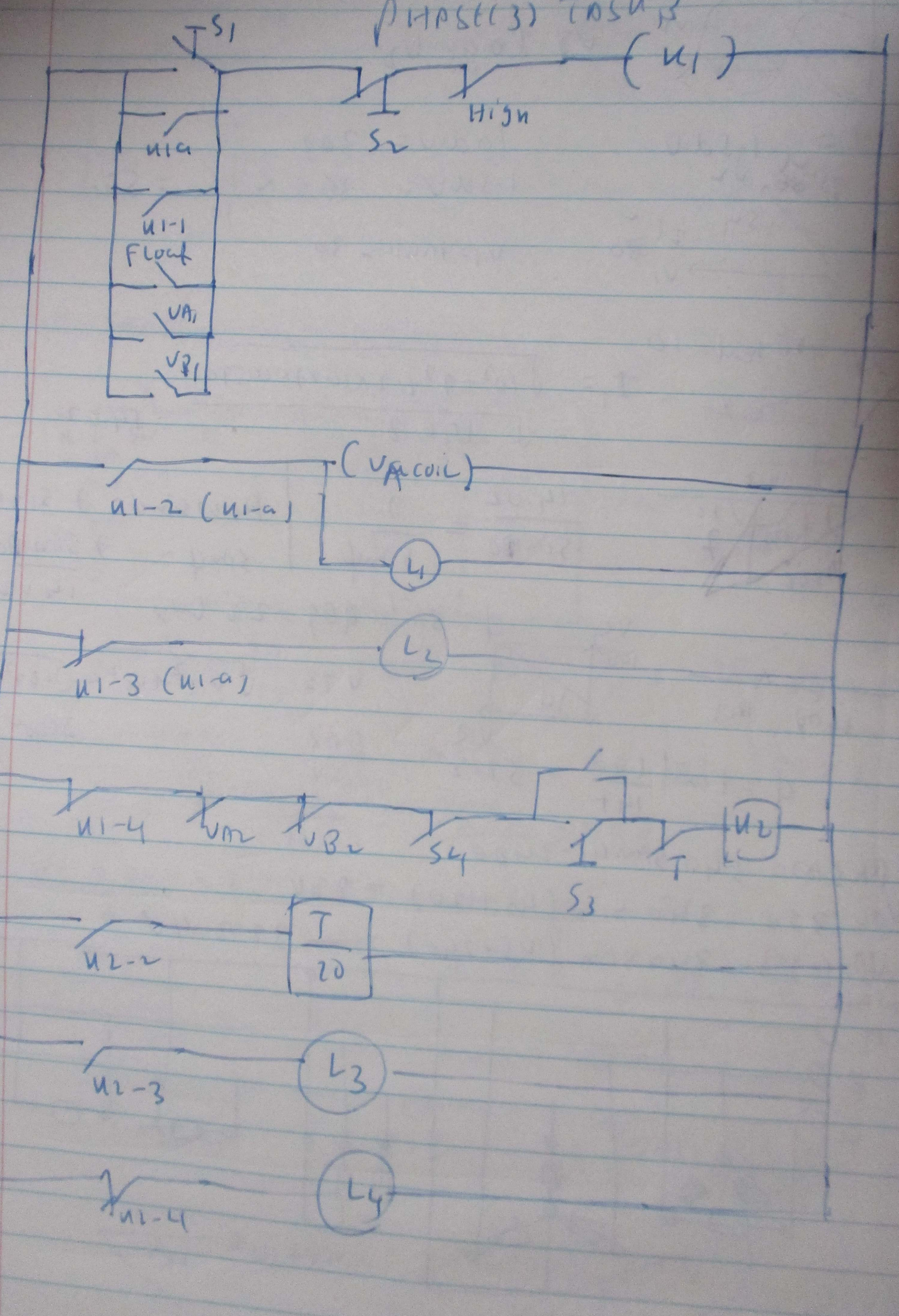
Important Information

PPE must be worn to attend the practical sessions.

$(W_1+W_2)\cos(-6)$ 0 to 90

$\phi = -60°$ pf .0.5 lag

$W_1 \pm W_2$ $\tan\phi = \frac{\sqrt{3}(W_1 - W_2)}{W_1+W_2} = 0$ $\phi = 0$ pf



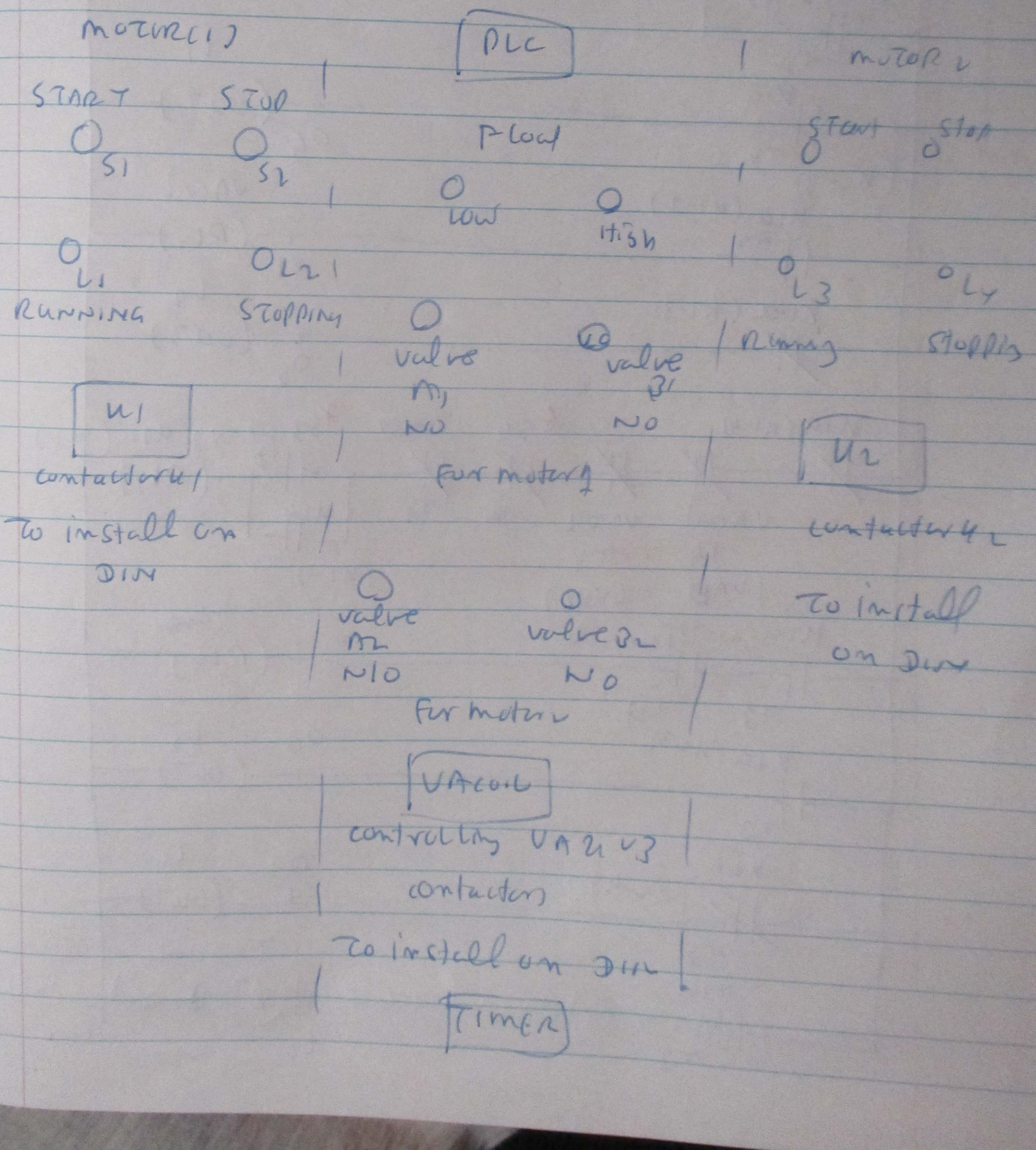
U1 control

3 MAIN + 2 NO Aux U1-1 (NC) | U1-3 (N/C
2 NC Aux U1-2 (NO | U1-4 (N/C)

U2 control

3 MAIN + U2-1 (NO) Aux | U2-3 (NC) Aux
U2-2 (NO) Aux | U2-4 (N/C) Aux

VA control VA1 (NO) VB1 (NC) parallel to S3
VA2 (NC) VB2 (NC) series to S3 S4



PLC

S1 (i1 ✓ i11) Flow Low (i2 ✓ i12) VA (i3 ✓ i13) VB (i4 ✓ i14) H1a (H1-2) r2

S2 (i11) Flow High (i12) (RL4) r2 — H1-a (H1)

H1a (H1-2) r2 — H1a (H1-3) r2 — L1 (OUT) O4

H1a (H1-2) r2 — VA Coil (RL4) r4 — H1-a (H1-3) — L2 (OUT) O5

H1a (H1-4) — VA Coil r4 (VA2) — VA Coil r4 (VB2) — i14 — r1 — H2a (H2-1) r2 — i18 S3 (i17) — r3 H2a (H2-1) (RL4)

H2a (H2-4) r3 — Timer Coil i17 i18 — r1 Timer (RL4)

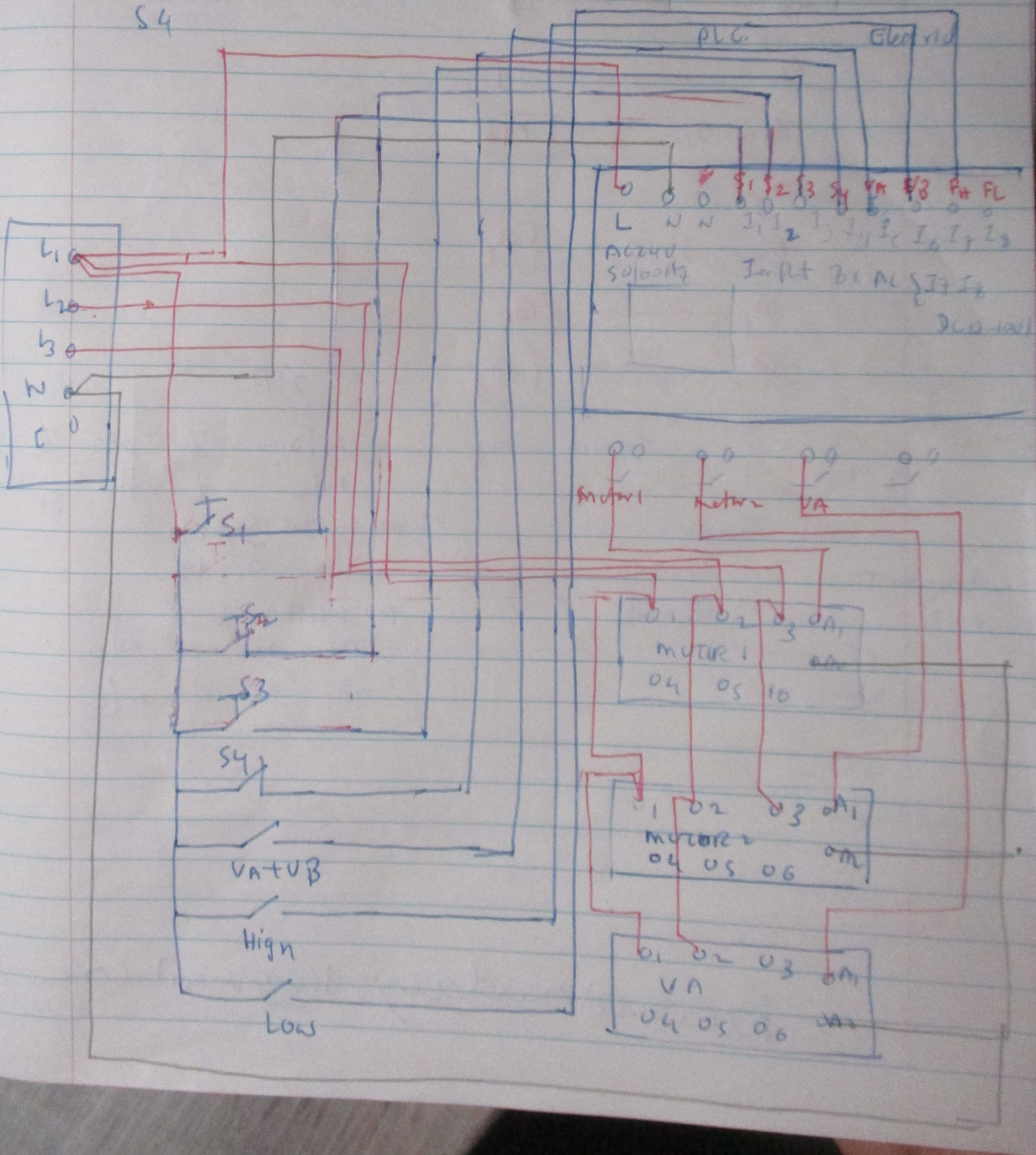
H2a (H2-3) r3 — O6 L3 (OUT)

H2a (H2-4) r3 — O7 L4 (OUT)

H2a r3 — Timer Coil (Tim) t1 — SV2

EASY 512 – AB – RC

INPUT	Timer	counter	Relay	output
S1	Timer1	Timer1	Timer	M1 –
Floatlow			M1a	M2 –
VA1			M2a	VA –
VB1			VA1/VB1	L1
S3				L2
S2				L3
Float High				L4
S4				



Extra sh
original program
I_3 — I_4 — I_5 — {M_1
I_1
I_2
θ_1
m_1 — θ_2 — — — {θ_1
I_5 ——— I_4
I_4 ——— $W\ T1$
I_7 · I_4 — I_2 — {M_2
θ_2
m_1 — I_2 — θ_1 — {θ_2
θ_1 — — — {θ_4
θ_L ——— {θ_3

Header N_2

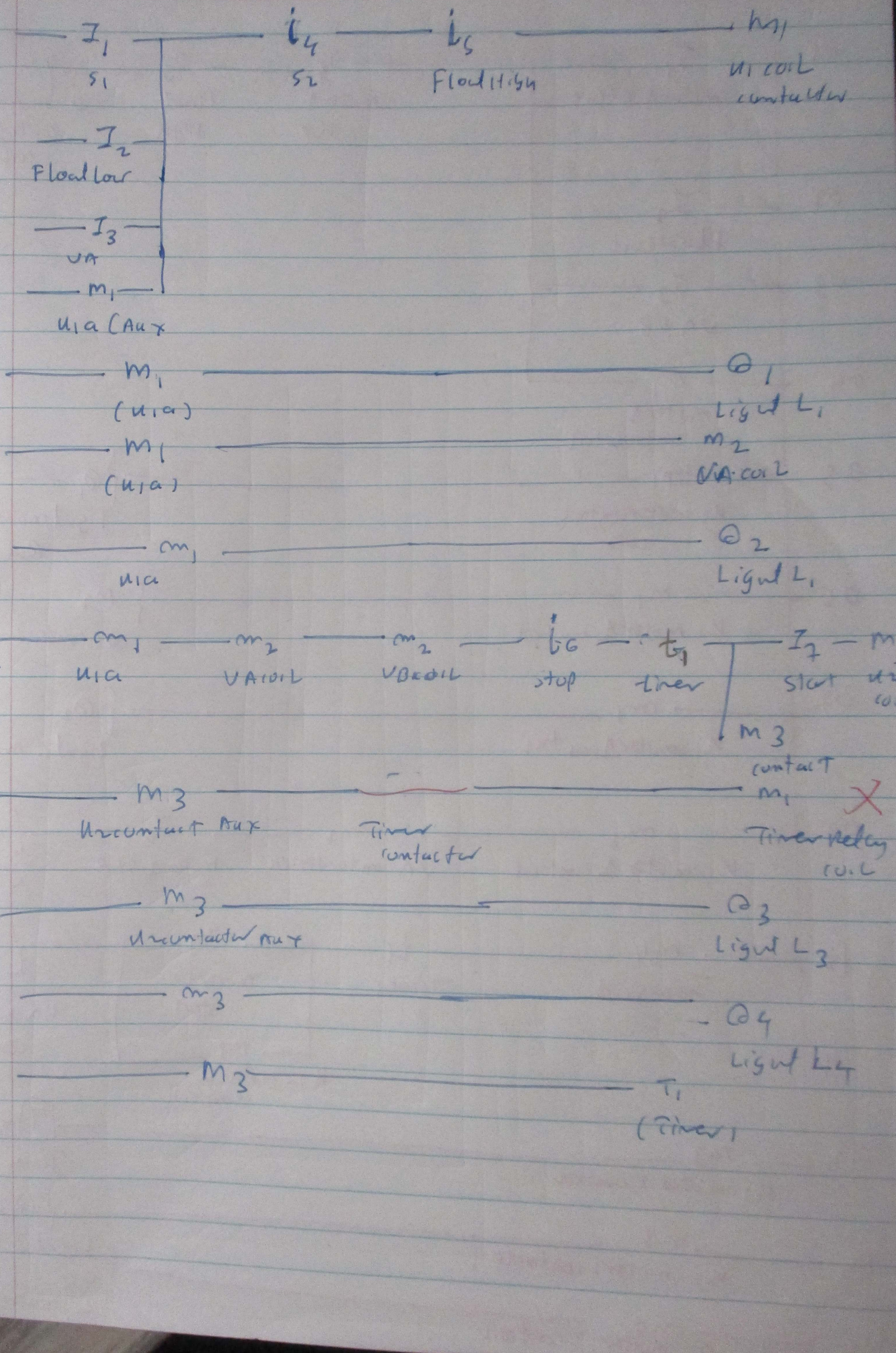
Footer
f_1 $N/0$
t_1 N/c

$N/0$ — I | $N/0$
N/c ! | N/c

Time Switch θ_1 $N/0$
θ_2 N/c

$Aux\ Relay$
$M1$ $Aux\ coil$ N/o
m_1 $aux\ co$ — N/c

IIP


I1
S1
i4
S2
i5
Float High
m1
M1 coil
contactor
I2
Float Low
MOTOR 1
I3
OR
m1
M1 aux contact
m1
(M1a)
Q1
Light L1
m1
(M1a)
m2
MA coil
m1
M1a
Q2
Light L1
MOTOR 2
m1
M1a
m2
MA coil
m2
MB coil
iG
stop
t1
timer
I7
m3
start
M3 coil
m3
contact
m3
M3 contact aux
Timer
contactor
m1
Timer relay
coil
m3
M3 contactor aux
Q3
Light L3
m3
Q4
Light L4
m3
T1
(Timer)

01 — I_1 motor 1 start — I_4 motor 1 Stop — I_5 Float High — { m_1 u_1 motor control coil

02 — I_2 Float low

03 — I_3 VA VB

04 — m_1 u_1 motor 1 control coil

05 — m_1 u_1 motor control coil — { O_1 Light motor 1 Run

06 — m_1 u_1 motor 1 control — { m_2 VA contactor coil

07 — m_1 u_1 motor 1 control — { O_2 Light 2 motor 1 Stop

08 — m_1 u_1 motor 1 control — m_2 VA contactor coil — I_6 motor 2 stop — { m_4 joining coil

10 — m_4 Joining coil — t_1 Timer — I_7 motor 2 start — { m_3 u_2 motor 2 control coil

11

12 — m_3 u_2 motor 2 control — { T_1 Timer

13 — m_3 u_2 motor 2 control coil — { O_3 Light 3 motor 2 Run

14 — m_3 u_2 motor 2 control coil — { O_4 Light 4 motor 2 Stop

{ m_1
U_1 motor control coil

{ Q_1 —— Light motor 1 Run

m_2
V Acontactor coil

{ Q_2

Impal

I_1 motor 1 start
I_2 Float low
I_3 VA V B
I_5 Float High
I_6 motor 2 stop
I_7 motor 2 start

output

Q_1 - Light motor 1 Run
Q_2 - Light 2 motor 2 start
Q_3 - Light 3 motor 2 Run
Q_4 - Light 4 motor 2 stop

Aux

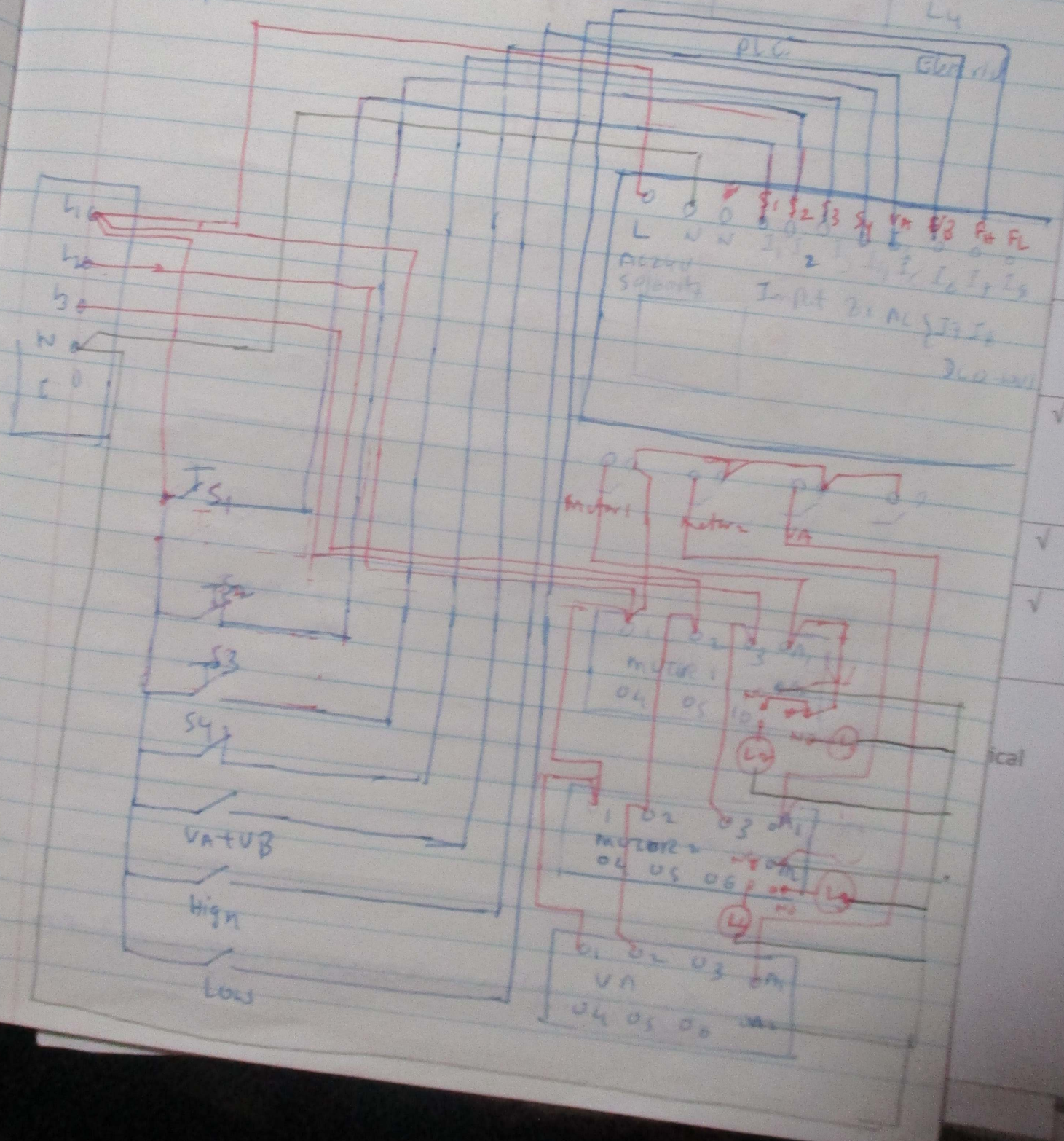
m_1 - U_1 motor 1 coil
m_2 - U_2 V Acontactor coil
m_3 - U_2 motor 2 coil
m_4 - Joining coil

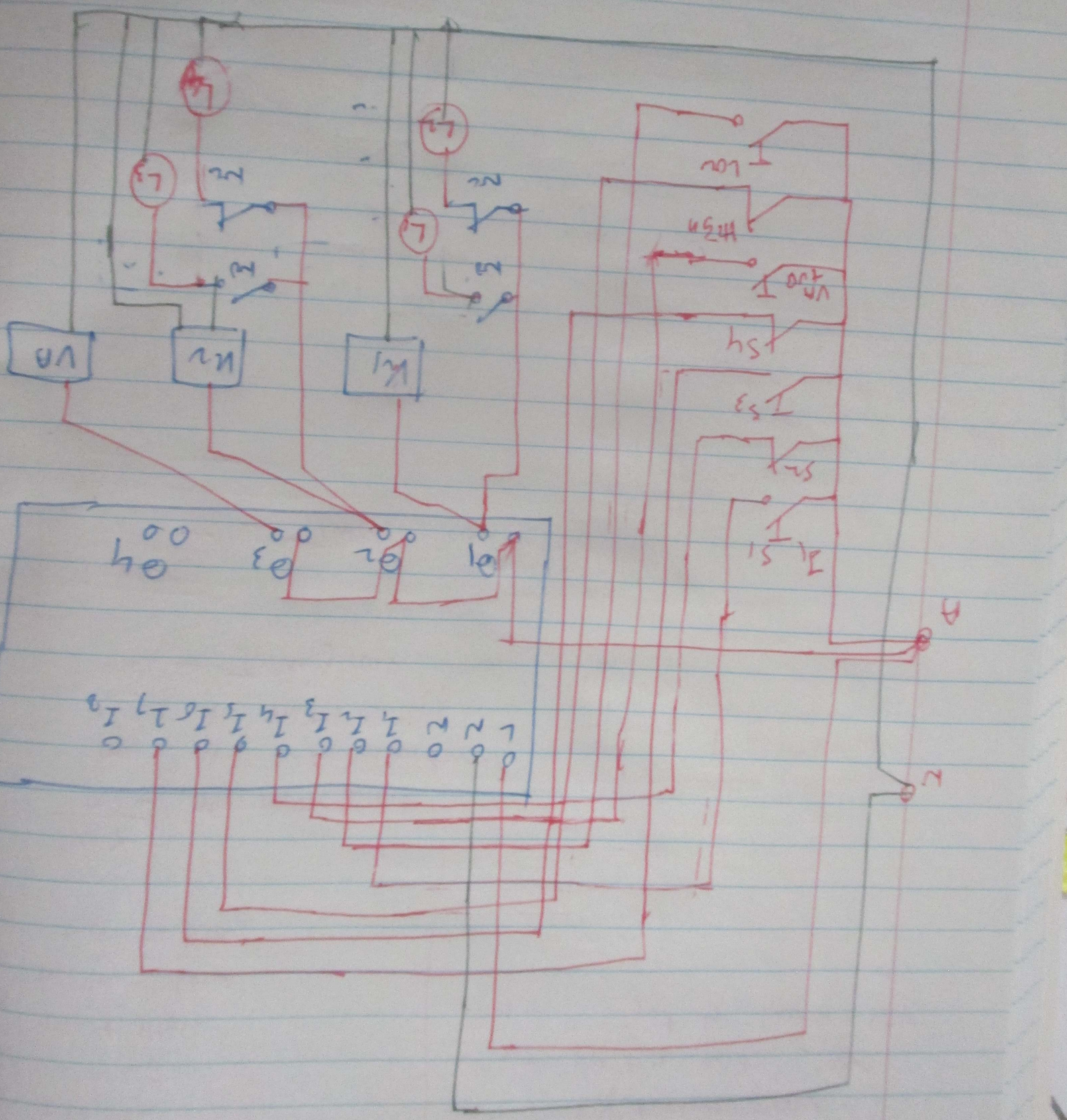
TIMER

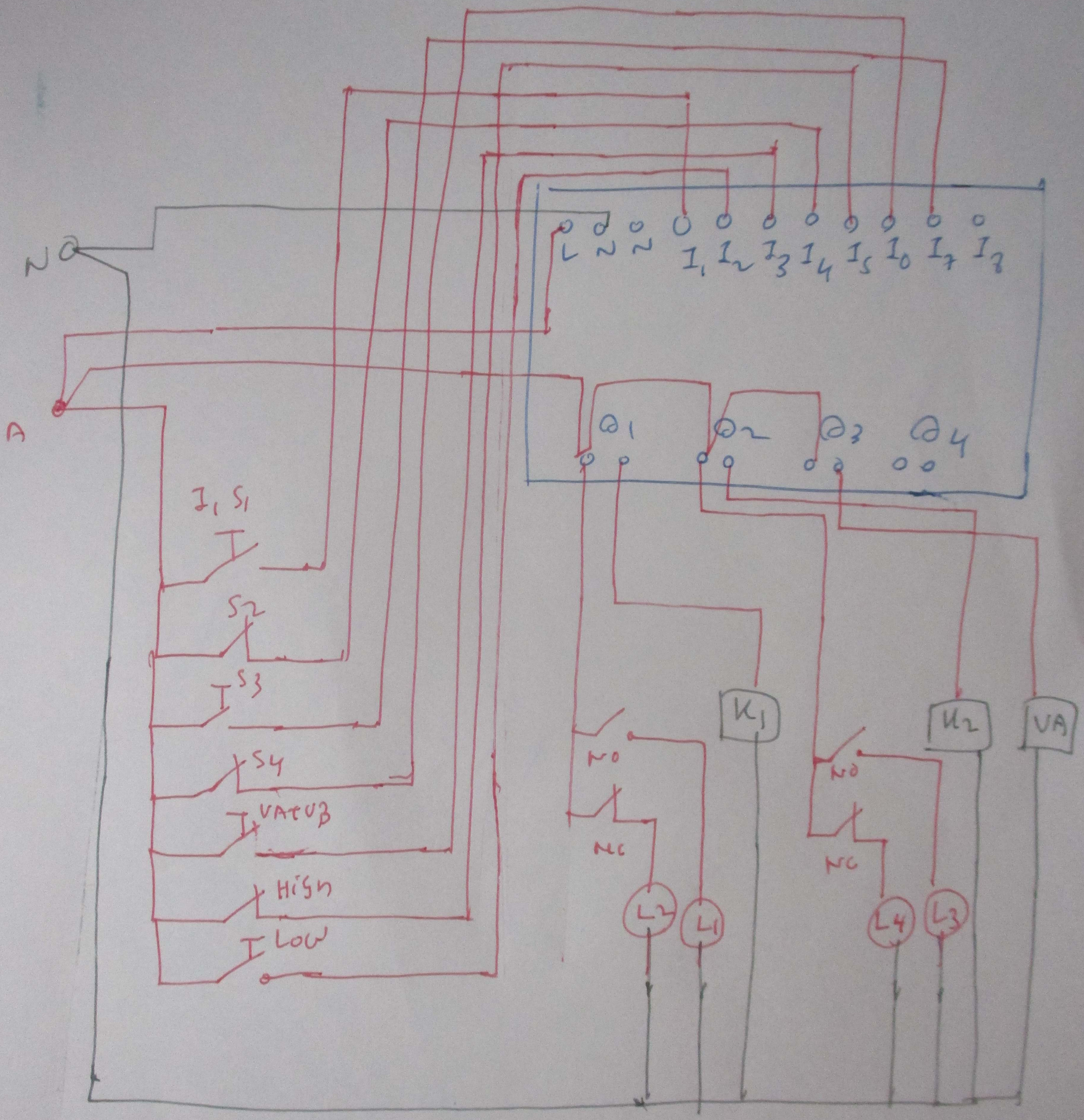
T_1 - TIMER ondelay

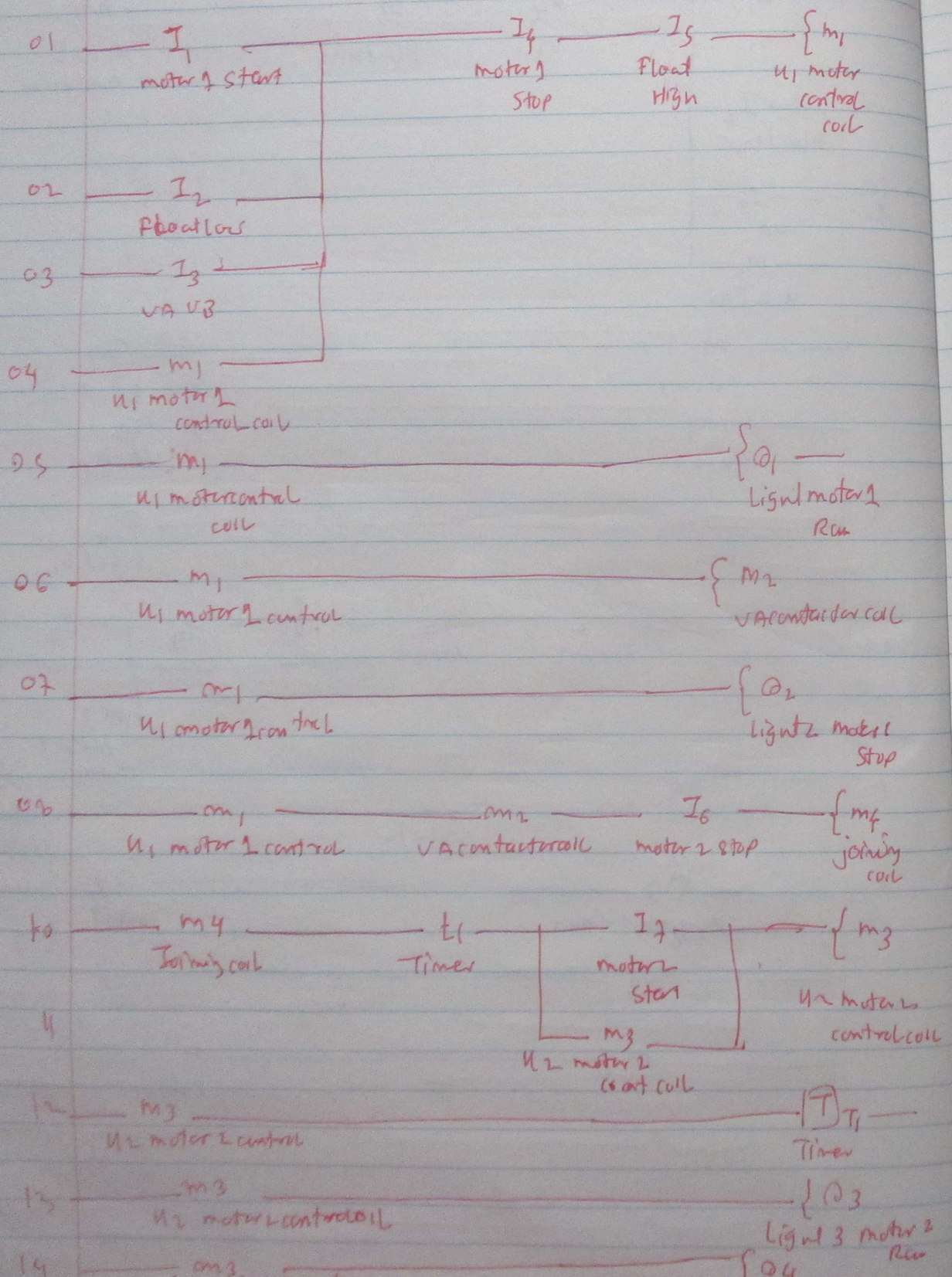
EASY S1Z — AB — RC

INPUT	Timer	counter	Relay	output
S1	Timer ON	Timer/counter	Timer	U1 –
Pload low			U1a	U2 –
VA1			U2a	VA –
VB1			VA/VB	L1
S3				L2
S2				L3
Float High				L4
S4				




L
N
1
2
3
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7
8
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94
95
96
97
98
99
100


N
A
L N N I1 I2 I3 I4 I5 I6 I7 I8
Q1 Q2 Q3 Q4
I1 S1
S2
I S3
S4
I VAtVB
HIGH
I LOW
K1
K2
VA
NO
NC
NO
NC
L2
L1
L4
L3



Impal

- I_1 motor 1 start
- I_2 Float low
- I_3 VA VB
- I_5 Float High
- I_6 motor 2 Stop
- I_7 motor 2 start

output

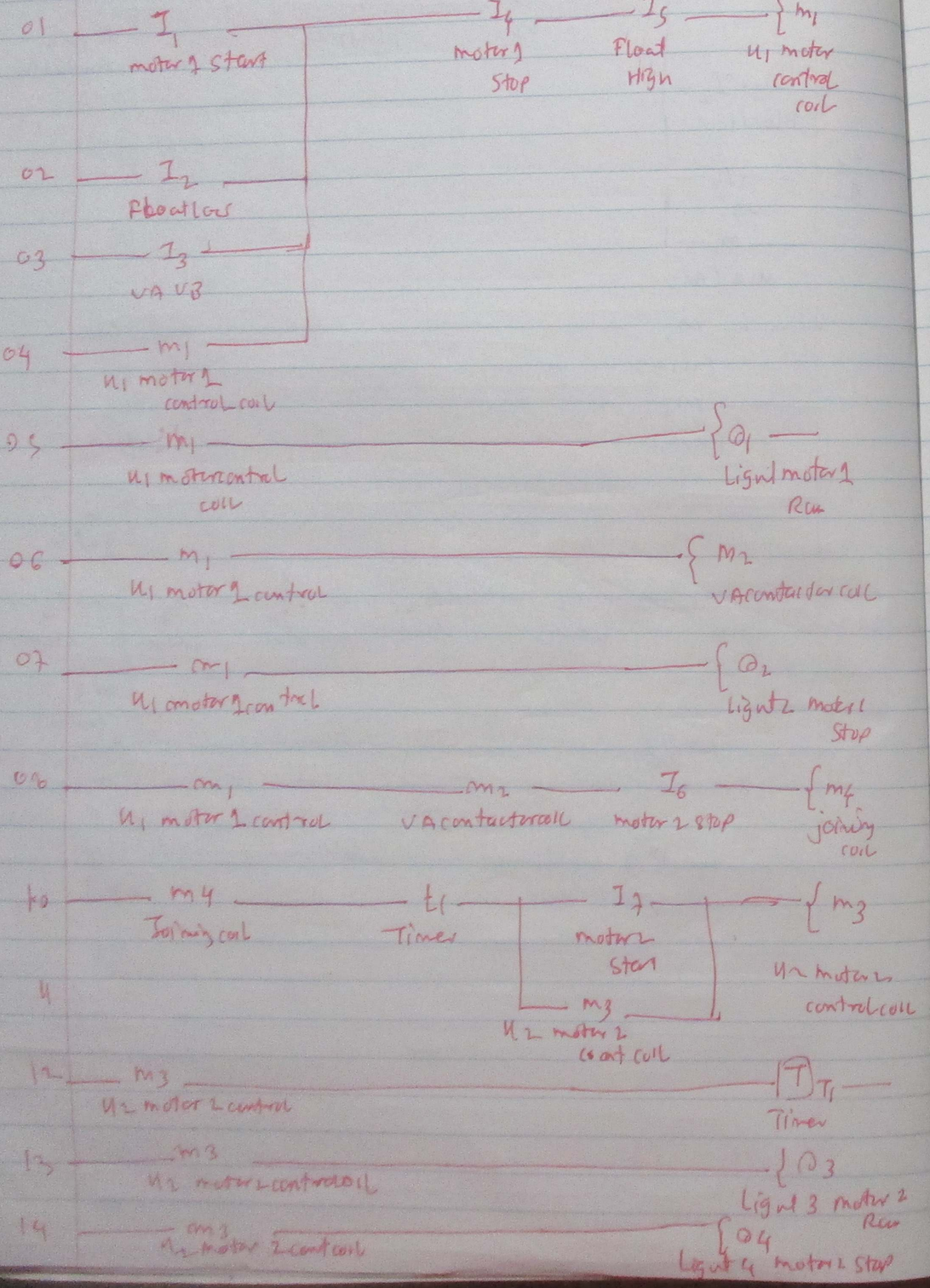
- O_1 – Light motor 1 Run
- O_2 – Light 2 motor 2 start
- O_3 – Light 3 motor 2 Run
- O_4 – Light 4 motor 2 Stop

Aux

- m_1 – M_1 motor 1 coil
- m_2 – M_2 VA Contactor coil
- m_3 – M_2 motor 2 coil
- m_4 – Joining coil

TIMER

- T_1 – TIMER ondelay



Input

- I_1 motor 1 start
- I_2 Float low
- I_3 VA VB
- I_5 Float High
- I_6 motor 2 Stop
- I_7 motor 2 start

output

- O_1 – Light motor 1 Run
- O_2 – Light 2 motor 2 Stop
- O_3 – Light 3 motor 2 Run
- O_4 – Light 4 motor 2 Stop

Aux

- m_1 – u_1 motor 1 coil
- m_2 – u_2 VA contactor coil
- m_3 – u_2 motor 2 coil
- m_4 – Joining coil

Timer

- T_1 – Timer on delay

01 — I_1 motor 1 start — I_4 motor 1 stop — I_5 Float High — m_1 u_1 motor control coil

02 — I_2 Floatless

03 — I_3 VA V_B

04 — m_1 u_1 motor 1 control coil

05 — m_1 u_1 motor control coil — O_1 Light motor 1 Run

06 — m_1 u_1 motor 1 control — m_2 VA contactor coil

07 — m_1 u_1 motor 1 control — O_2 Light 2 motor 1 Stop

08 — m_1 u_1 motor 1 control — m_2 VA contactor coil — I_6 motor 2 stop — m_4 joining coil

10 — m_4 Joining coil — t_1 Timer — I_7 motor 2 Start — m_3 u_2 motor 2 control coil

11

m_3 u_2 motor 2 contact coil

12 — m_3 u_2 motor 2 control — T_1 Timer

13 — m_3 u_2 motor 2 control coil — O_3 Light 3 motor 2 Run

14 — m_3 u_2 motor 2 cont coil — O_4 Light 4 motor 2 Stop

Supply

L

N

NO COM NC A N
(black) (white) (grey) (brown) (blue)
12-240 Vdc
24-240 Vac

Proximity Sensor 1

NO COM NC A N
(black) (white) (grey) (brown) (blue)
12-240 Vdc
24-240 Vac

Proximity Sensor 2

L N N I1 I2 I3 I4 I5 I6 I7 I8
AC 24V 50/60 Hz
8 Inputs
EATON
DEL ALT
ESC OK
EASY 512-AB-RC
4 outputs /8A
Q1 Q2 Q3 Q4

NC NO
Limit Switch 1

NC NO
Limit Switch 2

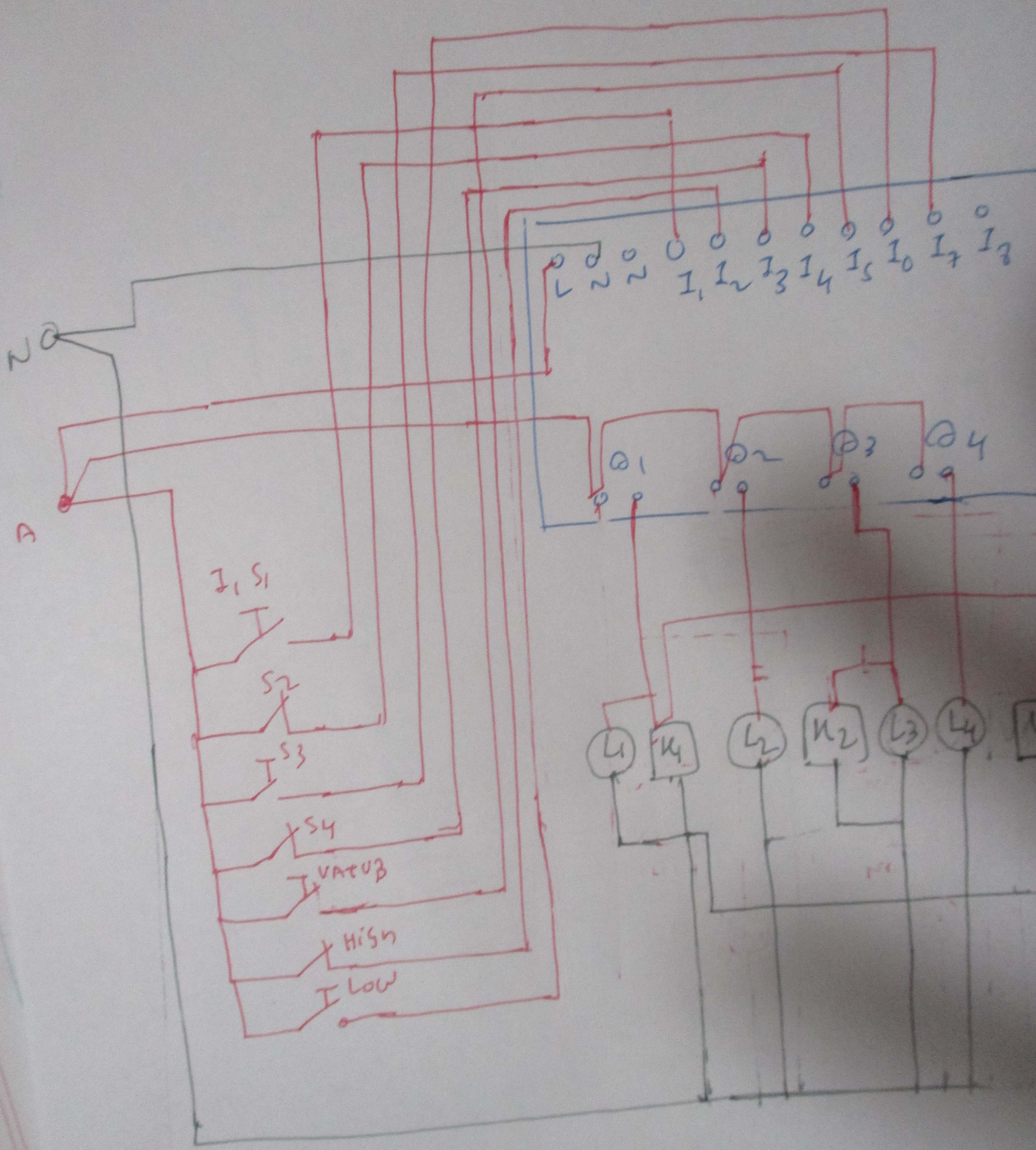
Start-Stop Station
START
NO position
STOP
NC position

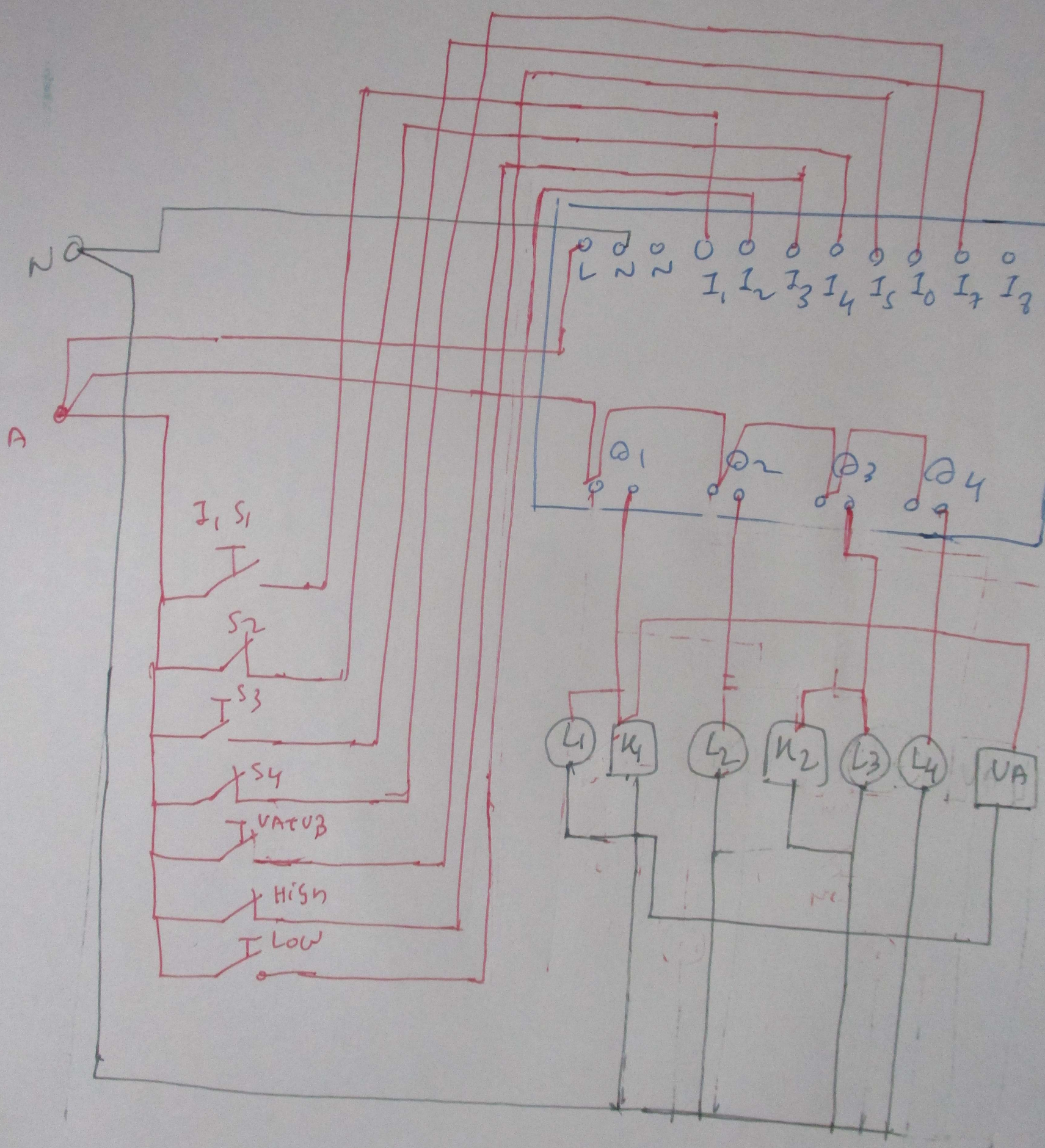
1 3 5 A1
2 4 6 A2
Contactor 1

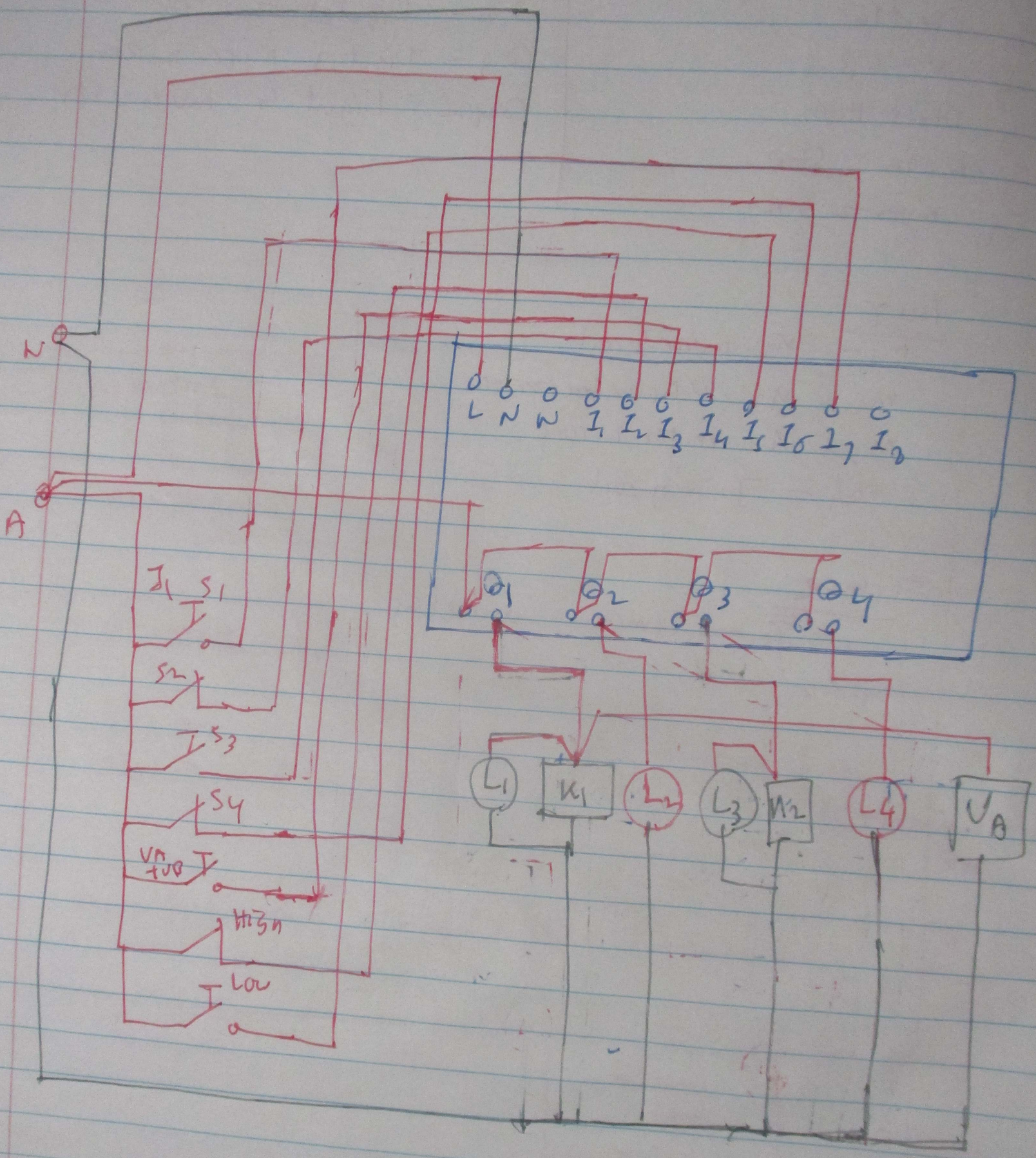
1 3 5 A1
2 4 6 A2
Contactor 2

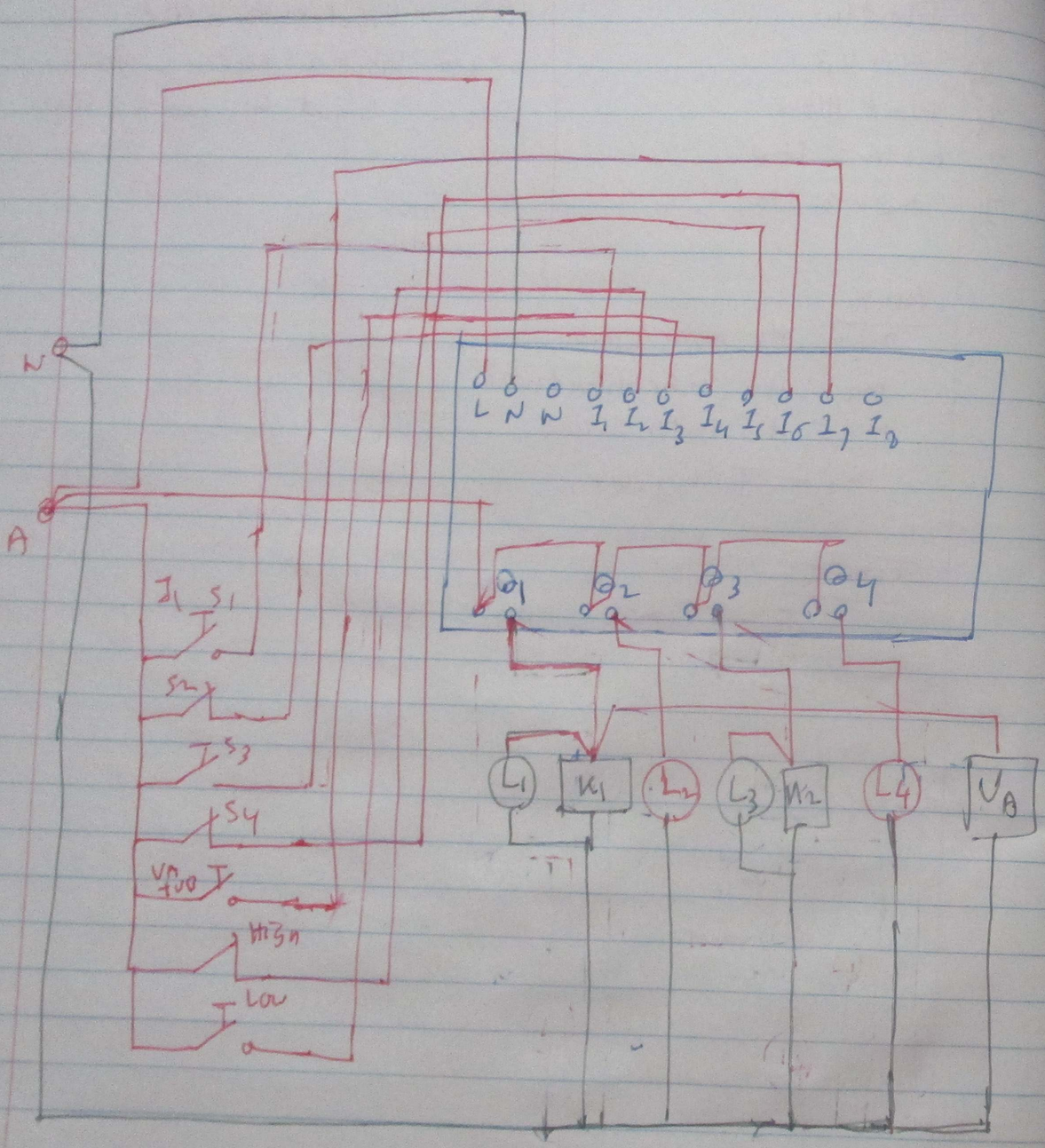
Indicator Lamp 1

Indicator Lamp 2


L N N I1 I2 I3 I4 I5 I0 I7 I8
N
A
I1 S1
S2
S3
S4
VATUB
High
Low
Q1 Q2 Q3 Q4
L1 K1 L2 K2 L3 L4


N
A
L N N I1 I2 I3 I4 I5 I6 I7 I8
Q1 Q2 Q3 Q4
I1 S1
S2
S3
S4
VA to VB
High
Low
L1 K1 L2 K2 L3 L4 VA


N
A
L N N I1 I2 I3 I4 I5 I6 I7 I8
I1 S1
S2
S3
S4
Vn +VB
High
Low
O1 O2 O3 O4
L1 K1 L2 L3 K2 L4 VB


N
A
L N N I1 I2 I3 I4 I5 I6 I7 I8
O1 O2 O3 O4
I1 S1
S2
S3
S4
Vfwd
High
Low
L1 K1 L2 L3 K2 L4 VB