SUMMER TRAINING ON

INDUSTRIAL CONTROL AND AUTOMATION

PROJECT REPORT ON

TRAFFIC SIGNAL CONTROL

CONDUCTED BY

INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL AND AUTOMATION

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INTRODUCTION

This project is based on the operation of a Traffic light control. The project involves various operations undertaken in a tea process plant, starting with Checking the level of the tank to drainage. The whole process is done automatically using Programmable Logic Controllers (PLC)s.

All the technical details and information regarding all the hardware and the software are given below

Operating System	Microsoft Windows 7/8/8.1/10
PC Configuration	Intel core i3/i5/i7, 1.7GHz, 4 GB RAM
1PLC Programming	Gx Works 2
Simulation Platform	Gx Simulator 2
Communication Protocol	Ethernet/USB(MULTI)
Communication Driver	Hardware driver
Drawing	AutoCAD 2012
Flow Chart	AutoCAD 2012
Documentation	Microsoft Word 07/10/13
Final Documentation	Adobe Reader
Documentation Platform	do PDF

Q Series PLC :

Memory

32,000 step EEPROM memory built-in. Battery-free and maintenance-free.
Processing speed
Basic instruction: 0.21μs/instruction (in standard mode) 0.42μs/instruction (in extension mode)
Application instruction: 0.5 to 100 μs/instruction (in standard mode) 1.2 to 100 μs/instruction (in extension mode)

Device

Auxiliary relay: 7,680 pts Timer: 320 pts Counter: 235 pts Data register: 8,000 pts
Extension register: 24,000 pts Extension file register: 24,000 pts

.Features:

Integrated power supply (AC or DC powered)
Maintenance-free EEPROM memory
Ample memory capacity (2000 steps) and device ranges
High-speed operations
Incorporated positioning control
Integrated real-time clock
System upgrades by exchangeable interface and I/O adapter boards for base unit
LEDs for indicating the input and output status
Standard programming unit interface
User-friendly programming systems, including IEC 61131.3 (EN 61131.3)-compatible programming software, HMIs and hand-held programming units • Device Net, and Ethernet/IP – via the Communications Port (Channel 0) on the Base Unit
• Communications toggle push button
• An additional communication port called the Programmer/HMI
• Port, providing additional connectivity of a DF1-Full Duplex compatible device such as an operator interface or programming terminal (1762-LxxxxxR processor only)
• Data file download protection prevents critical user data from being altered via communications
• Two built-in analog trim potentiometers
• Optional real-time clock
• Optional memory module
• 20 kHz high-speed counter, featuring 8 modes of operation
• One high-speed output that can be configured as 20 kHz PTO

• (Pulse Train Output) or as PWM (Pulse Width Modulated) outputs
• Four high-speed latching (pulse-catch) inputs
• 32-bit signed integer math
• High-resolution, 1 ms timers
• Floating-point data file
• Built-in PID capabilities
• ASCII read/write capability
• Four event interrupt inputs (EII)
• One, 1 ms, selectable timed interrupt (STI)
• Finger-safe terminal blocks meet global safety standards
• Removable terminal blocks on 40-point controllers allow pre-wiring
• Regulatory agency certifications for world-wide market (CE,
• C-Tick, UL, c-UL, including Class I Division 2 Hazardous Location

Hardware description

PLC	MELSEC-Q(Q03UDE)
PC-PLC Communication Cable	Ethernet/USB/(MULTI)

TRAFFIC SIGNAL

In a cross road there are three traffic lights (red, green, yellow) in each directions (northbound & eastbound). At first there will be light in both directions.

Sequential order will be:

Red-Yellow-Green (northbound), Red-yellow-Green (eastbound)
0 means light is off, 1 means light is on.

Example:
100, 001
means red light northbound and green light eastbound.
100, 010
means red light northbound and Yellow light eastbound.

Now, Here's what the sequencer will look like in order. We'll start with a red light in both directions. Then the eastbound will turn green first and we'll progress from there.
Follow each step bellow.

100100 → red, red
100001 → red, green
100010 → red, yellow
001100 → green, red
010100 → yellow, red
repeat

As it turns out, the 1's and 0's are all set for our memory locations.

Ok. So our sequence has 5 steps. (from red, red through yellow, red)
How will we progress from step to step? In other words will we need a timer or event based sequencer? Yes, a timer- based sequencer will be needed of course.

We'll start at red, red. Wait 5s, then red, green. Wait60s then red, yellow. Wait 10s then green, red. Wait 60s then yellow, red. Wait 10s then red, red. Repeat the case.

SYSTEM COMPONENTS

1. INDICATING LAMPS :

An indicator lamp is a warning device used to alert drivers of potential problems with their vehicles. Functions such as oil pressure, water temperature and the voltage are all typically wired into dashboard indicator lamps. When there is a potential problem or a dangerous reading from a engine sensor, the indicator lamp will illuminate. Many vehicles have both full-functioning gauges that show the reading of the function as well as an indicator lamp. Typically, lower-optioned and base-packaged vehicles will possess only the indicator lamp system.

2.PUSH BUTTONS:

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal.[1] The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state. Terms for the "pushing" of a button include pressing, depressing, mashing, slapping, hitting, and punching.

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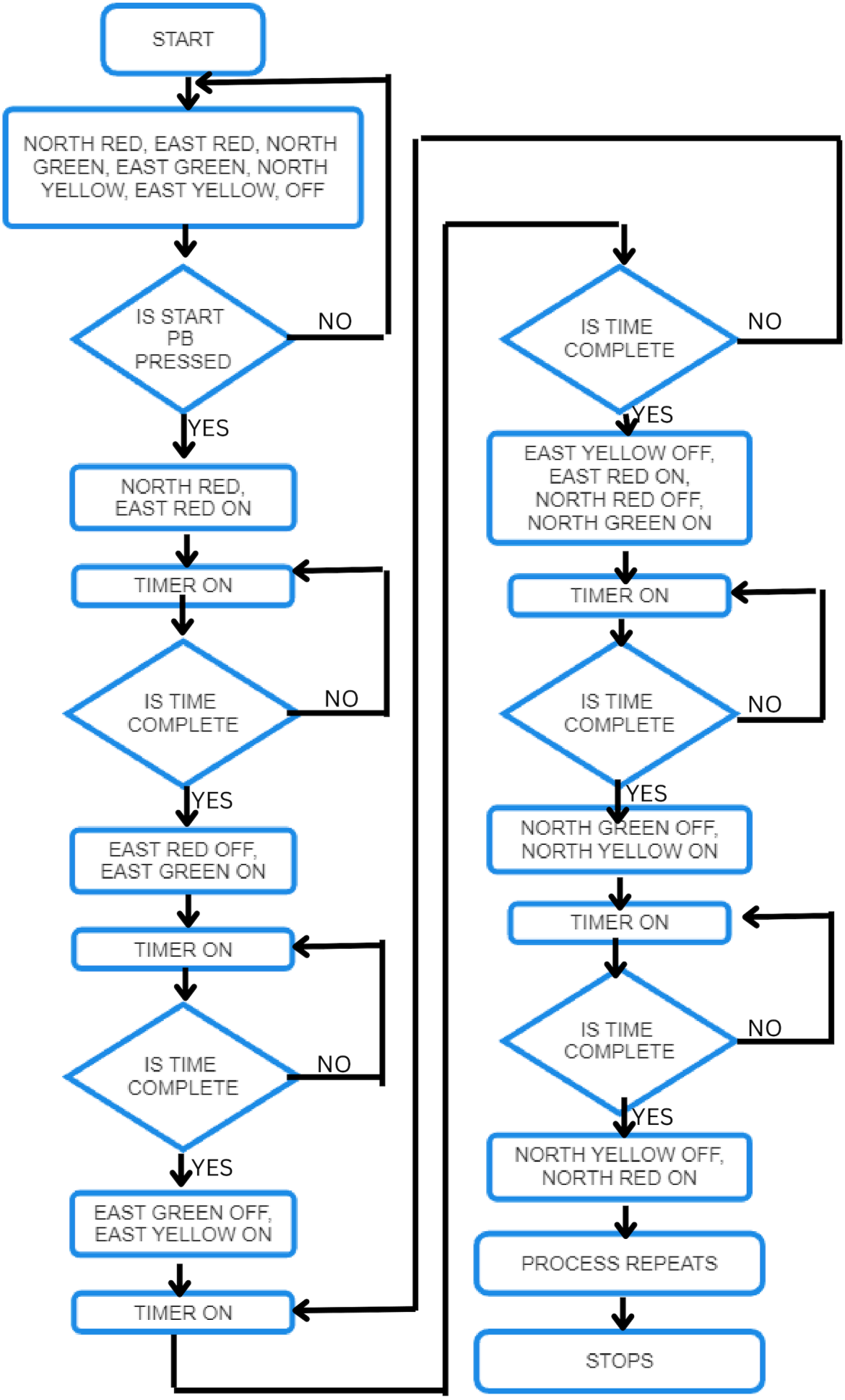
Control Philosophy

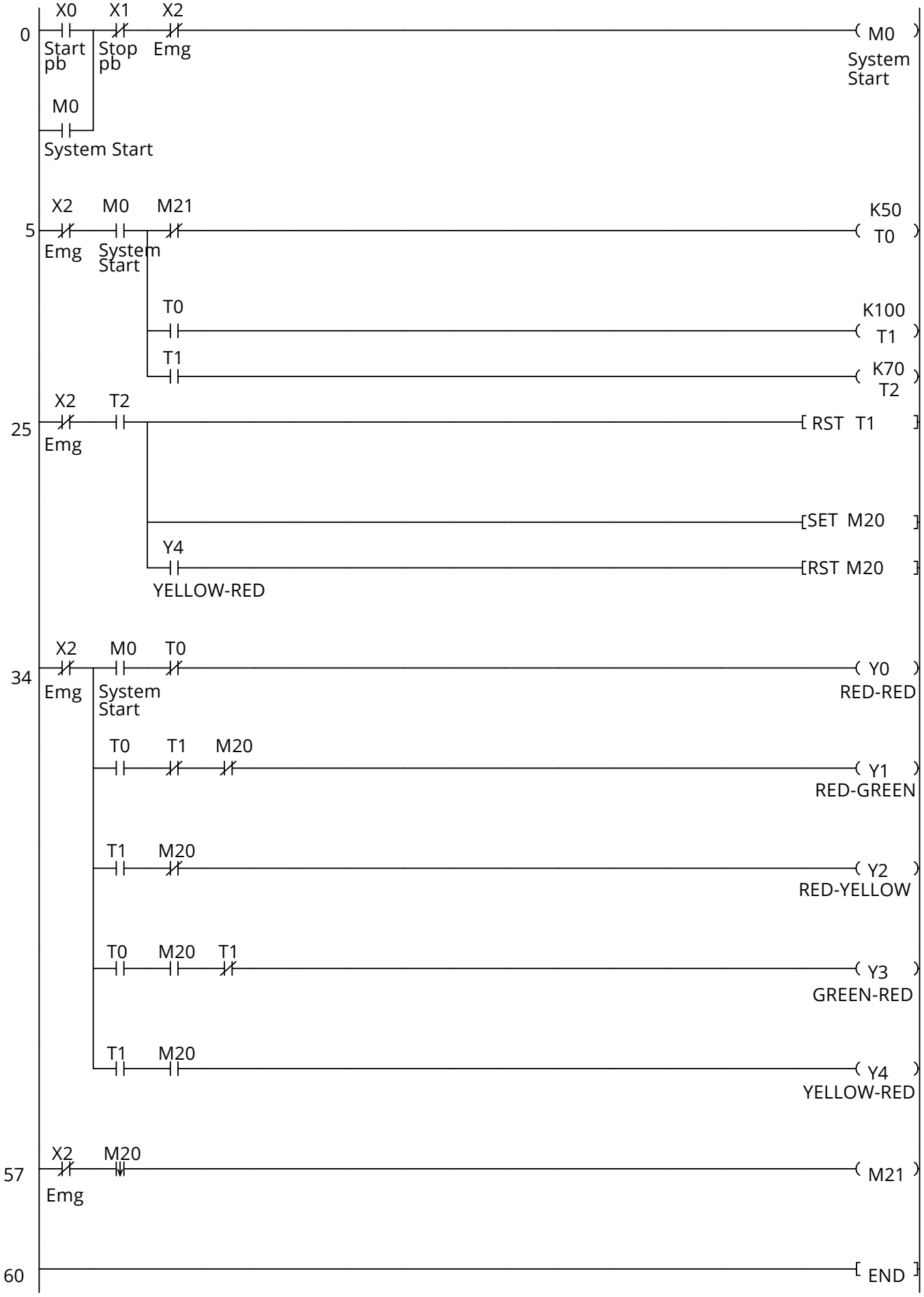
This involves the use of timed signal phases, sensor data, and adaptive algorithms to minimize congestion and reduce wait times. Traffic signals are designed to prioritize main thoroughfares while providing adequate crossing opportunities for side streets and pedestrians. The system adapts to real-time traffic conditions, using technologies like inductive loop detectors, cameras, and AI to dynamically adjust signal timings. Coordination between adjacent signals, known as signal synchronization or "green waves," aims to create smooth traffic flow along corridors. Safety is paramount, with signals programmed to minimize conflict points and ensure clear, predictable movements for all road users. The overarching goal is to balance the needs of different traffic streams, enhance road capacity, and improve overall travel experience.

Flow Chart

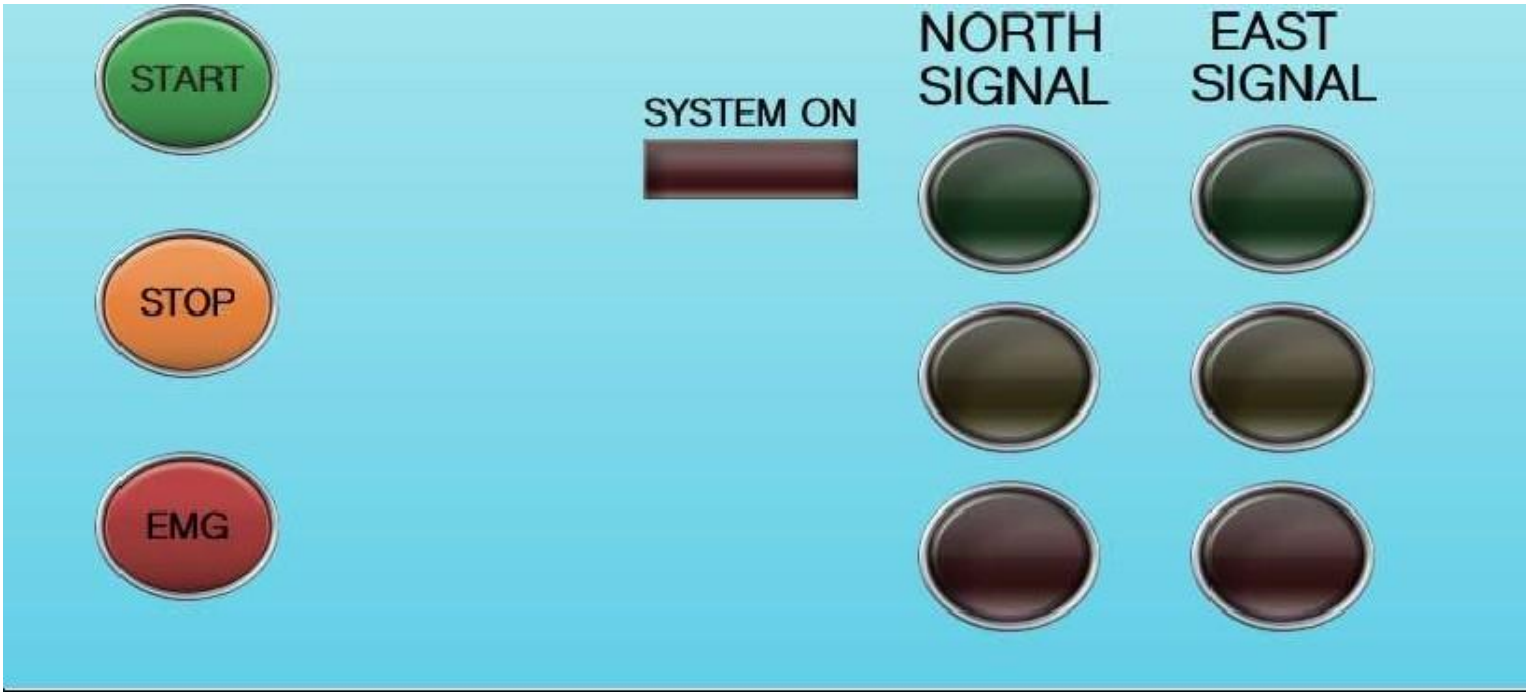

START
NORTH RED, EAST RED, NORTH GREEN, EAST GREEN, NORTH YELLOW, EAST YELLOW, OFF
IS START PB PRESSED
NO
YES
NORTH RED, EAST RED ON
TIMER ON
IS TIME COMPLETE
NO
YES
EAST RED OFF, EAST GREEN ON
TIMER ON
IS TIME COMPLETE
NO
YES
EAST GREEN OFF, EAST YELLOW ON
TIMER ON
IS TIME COMPLETE
NO
YES
EAST YELLOW OFF, EAST RED ON, NORTH RED OFF, NORTH GREEN ON
TIMER ON
IS TIME COMPLETE
NO
YES
NORTH GREEN OFF, NORTH YELLOW ON
TIMER ON
IS TIME COMPLETE
NO
YES
NORTH YELLOW OFF, NORTH RED ON
PROCESS REPEATS
STOPS

Ladder Diagram

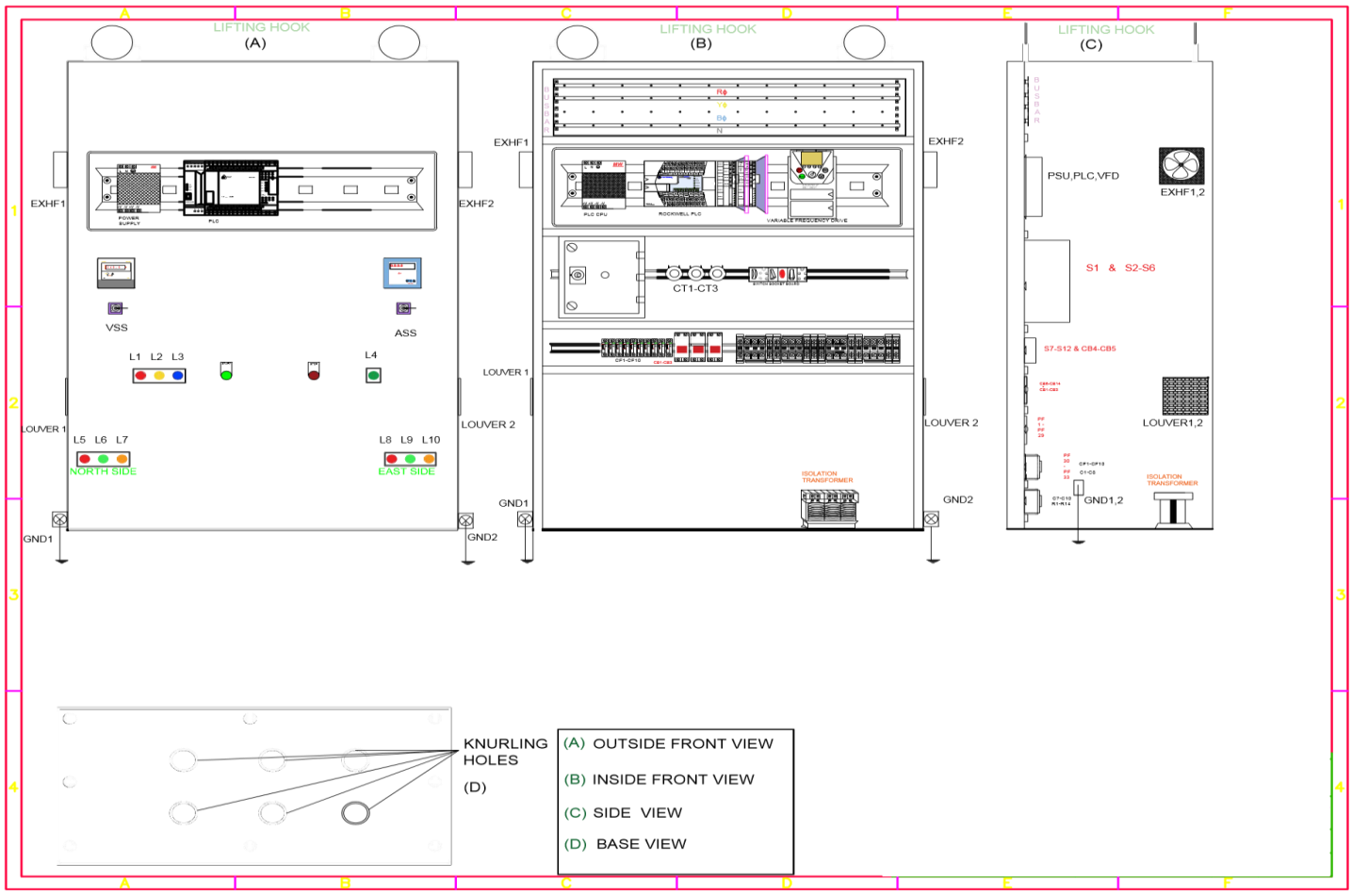
Project: Traffic Signal Control



TRAFFIC SIGNAL CONTROL HMI



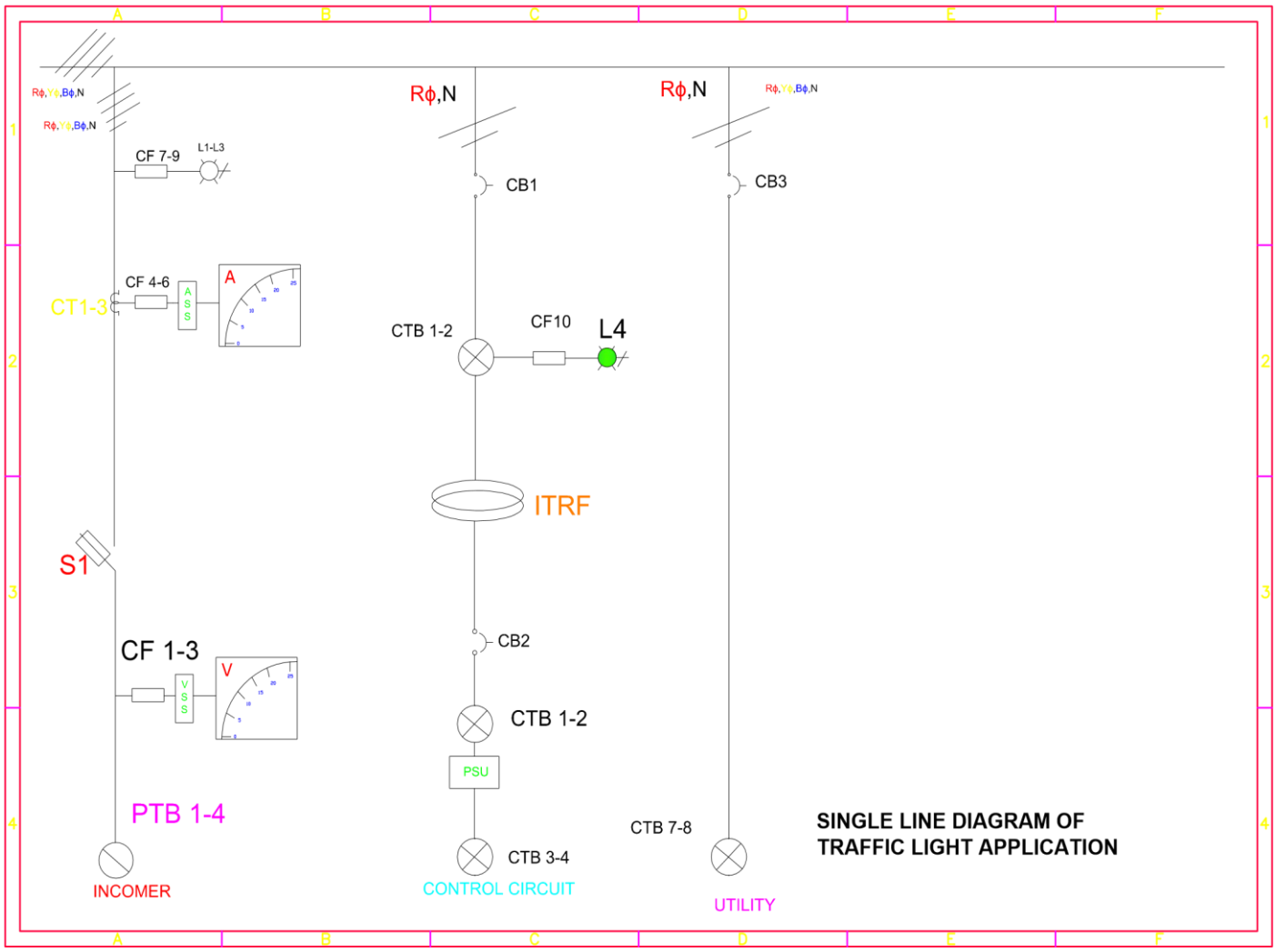
General Arrangement of Control Pannel



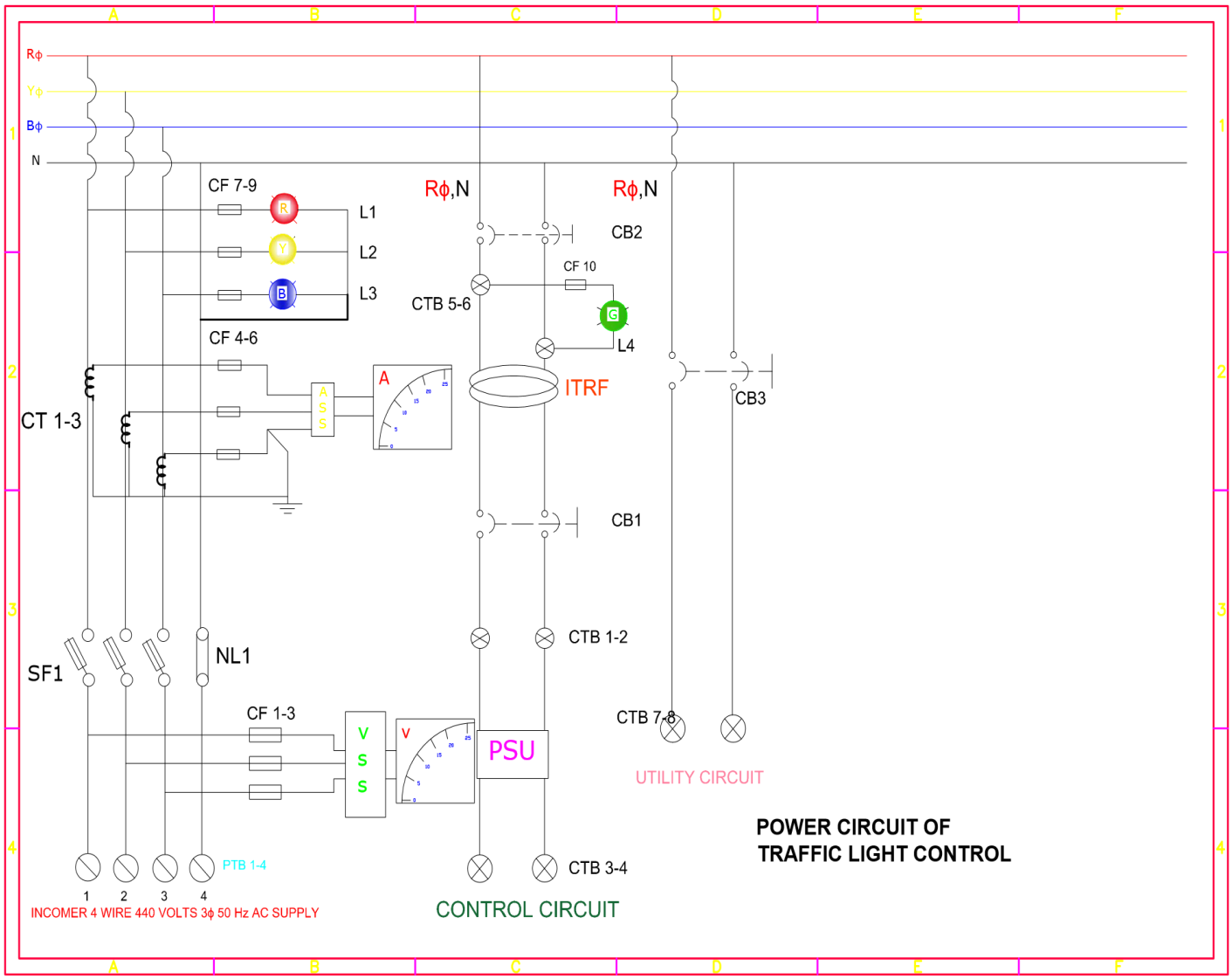
LEGEND DETAILS

Sl. No.	Tag	Material Description	Range/Rati ng	Type	Make	Qty
1	PLC	Programmable Logic Controller	I/P- 32 pts, O/P-32 pts, 24V DC	MELSEC Q Series, Q03UDE	Mitsubishi Electric	1
		Communication Cable	RJ-45	Ethernet	N/A	1
2	PSU	Power Supply Unit	5A	I/P- 230V AC, O/P- 24V DC	Meanwell	1
3	ITRF	Isolation Transformer	5VA, CTR- 1:1	I/P- 230V AC, O/P- 230V AC	Gupta Engg.	1
	CB1CB3	DP MCB	10A, Breaking Capacity 6kA	C-curve, Isolator type	Siemens	3
4	A	Ammeter	0-100A	Analog,72 sq. Mm	Meco	1
5	ASS	Ammeter Selector Switch	6A	4 position (with Off)	Kaycee	1
6	V	Voltmeter	0-500V	Analog,72 sq. Mm	Meco	1
7	VSS	Voltmeter Selector Switch	6A	4 position (with Off)	Kaycee	1
8	CF1-10	Control Fuse	2A	with Base mfg.	GEC	10
9	L1, L2, L3 ETC	Panel Indicating Lamps		Red, Yellow, Blue, Green	Siemens	10
10		Other Hardware	Various Size	Various type	Reputed	Bulk

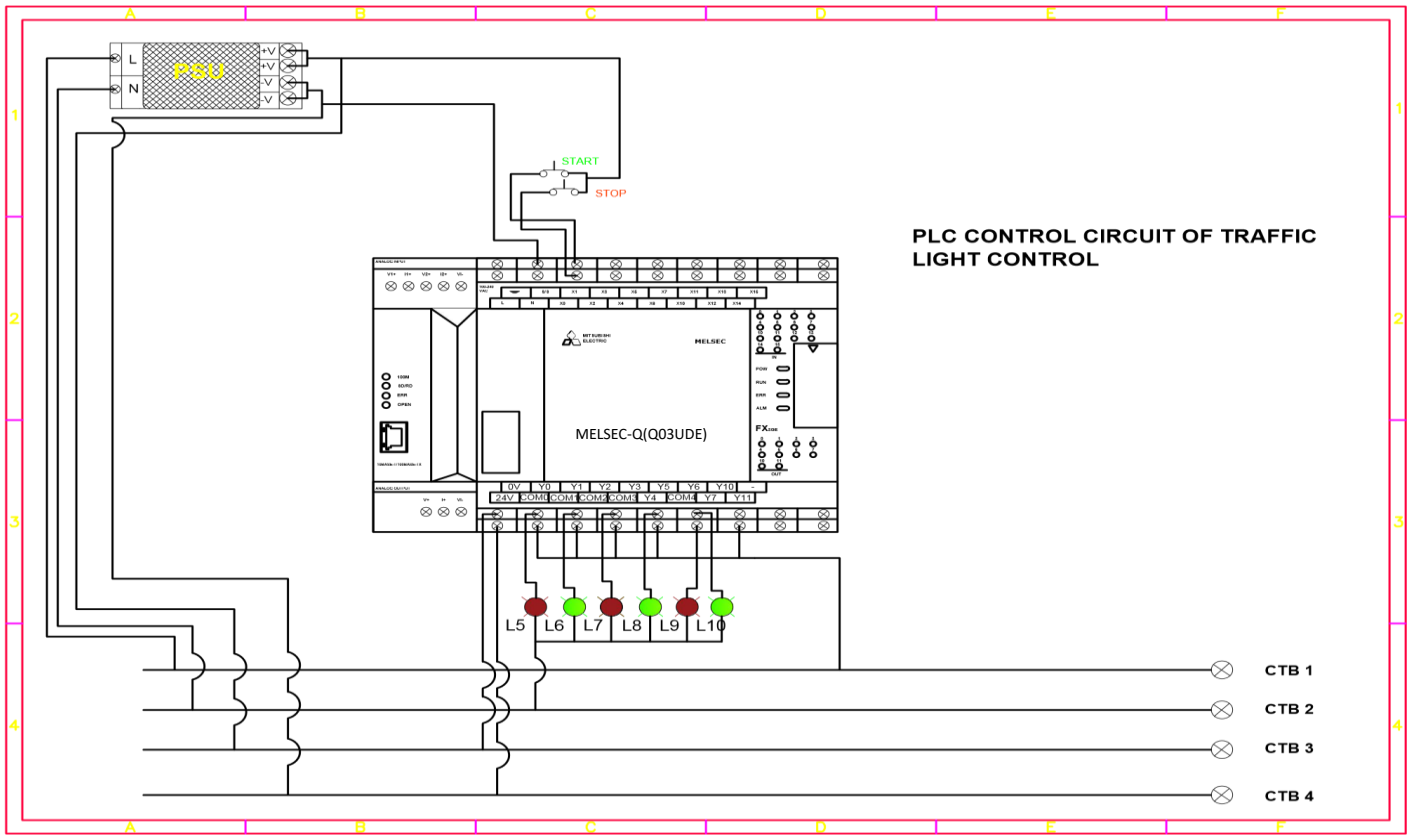
Single Line Diagram



Power Circuit of Traffic Light Control



PLC Control circuit of Traffic Signal Control



	BILL OF MATERIALS				
Sl. No.	Material Description	Range/Rating	Type	Make	Qty
1	Programmable Logic Controller	I/P- 32 pts, O/P-32 pts, 24V DC	MELSEC Q Series, Q03UDE	Mitsubishi Electric	1
2	Communication Cable	RJ-45	Ethernet	N/A	1
3	Power Supply Unit	5A	I/P- 230V AC, O/P- 24V DC	Meanwell	1
4	Isolation Transformer	5VA,CTR- 1:1	I/P- 230V AC, O/P- 230V AC	Gupta Engg.	1
5	Ammeter	0-100A	Analog,72 sq. Mm	Meco	1
6	Ammeter Selector Switch	6A	4 position (withOff)	Kaycee	1
7	Voltmeter	0-500V	Analog,72 sq. Mm	Meco	1
8	Voltmeter Selector Switch	6A	4 position (withOff)	Kaycee	1
9	Control Fuse	2A	with Base mfg.	GEC	10
10	Panel Indicating Lamps		Red, Yellow,Blue,Green,	Siemens	10
11	Other Hardware	Various Size	Various type	Reputed	Bulk

SHEET METAL CALCULATION

Panel Height : 500 mm. = 0.5 m.
Width : 500 mm. = 0.5 m.
Depth : 300 mm. = 0.3 m.
Mounting plate : 350 mm. (H) X 400 mm. (W)
Material of Construction : 2 mm. CRCA, TISCO

Sheet metal required for
A] Cubicle body of the control panel:
= 2[(0.5*0.5)+(0.5*0.3)+(0.3*0.5)] sq.m.
= 2[0.25+0.15+0.15] sq.m.
= 2 * 0.55 sq. m.
= 1.1 sq. m.

B] Mounting plate of the control panel:
= 350 mm. * 400 mm.
= 0.35 m * 0.4 m.
= 0.14 sq. m.

Total Sheet Metal required for control panel [A+B]:
= (1.1+0.14) sq.m. * 16 kg.
[Since, Weight of 2 mm. CRCA: 16 kg/m^2]
= 1.24 sq.m*16 k.g =19.84@ Rs. 180/-
[Cost includes sheet metal cost, transportation, fabrication, painting, electricity, packing, forwarding, labor charge etc.]
= Rs. 3572/-
Say: Rs. 5000/-
[Rupees Five Thousand only]

COST ANALYSIS

Sl. No.	Material Description	Range/Rating	Type	Make	Qty	Unit Price	Total Price
1	Programmable Logic Controller	I/P- 32 pts, O/P-32 pts, 24V DC	MELSEC Q Series, Q03UDE	Mitsubishi Electric	1	50,000	50,000
2	Communication Cable	RJ-45	Ethernet	N/A	1	200	200
3	Power Supply Unit	5A	I/P- 230V AC, O/P24V DC	Mean well	1	1250	1250
4	Isolation Transformer	5VA,CTR-1:1	I/P- 230V AC, O/P230V AC	Gupta Engg.	1	1400	1400
5	Ammeter	0-100A	Analog,72 sq. Mm	Meco	1	650	650
6	Ammeter Selector Switch	6A	4 position (withOff)	Kaycee	1	150	150
7	Voltmeter	0-500V	Analog,72 sq. Mm	Meco	1	650	650
8	Voltmeter Selector Switch	6A	4 position (withOff)	Kaycee	1	150	150
9	Control Fuse	2A	with Base mfg.	GEC	10	25	250
10	Panel Indicating Lamps		Red, Yellow,Blue,Green,	Siemens	10	150	1500
11	Other Hardwares	Various Size	Various type	Reputed	Bulk	7500	7500
TOTAL COST						63,700	

CONCLUSION

This project is based on complete designing of an automated Traffic Light control . This complete hands-on designing project has given a virtual insight on the automated processing of tea in plant and enables me to get a virtual overall idea about the process of planning and getting to familiarize about the fundamental building blocks that helps in the assembly and creation of an automated project.