



A

Project On

WATER CONTORL SYTEM

By

PLC

Submitted by:

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Introduction

A PLC (i.e. Programmable Logic Controller) is an industrial computer that monitors inputs, make decisions based on its program and control outputs to automate a process or machine. It was invented to replace the conventional relay logic circuits for machine and process control. PLC's are used in many "Real World" applications. Particularly in the field of machining, packaging, material handling, automated assembly or countless other Industries the application that needs some type of electrical control has a need for a PLC. Here, I'm using a Q series PLC of Mitsubishi company for a water control system. Because by using PLC, the control system will be more reliable and cost effective.

Mitsubishi PLC Description

Features of Q series PLC:

- I/O range is more than 1024
- Functionality is modularized
- Expansion of racks also
- I/O distribution on network like CC-Link
- Processing time: 79 to 34 nSec, QnU: 9.5 nSec

System Description

A PLC is to control an amusement park water ride. The ride is associated with a tank of water and splash a tour group. The ride full with tour group is sensed by '*cart detect*' limit switch. The water tank is associated with two solenoid operated valve and corresponding level sensor. The '*filling valve*', accompanied by '*level full sensor*', is at the top end of the water tank whereas the '*outlet valve*', accompanied by '*level empty sensor*', is at the bottom of the water tank.

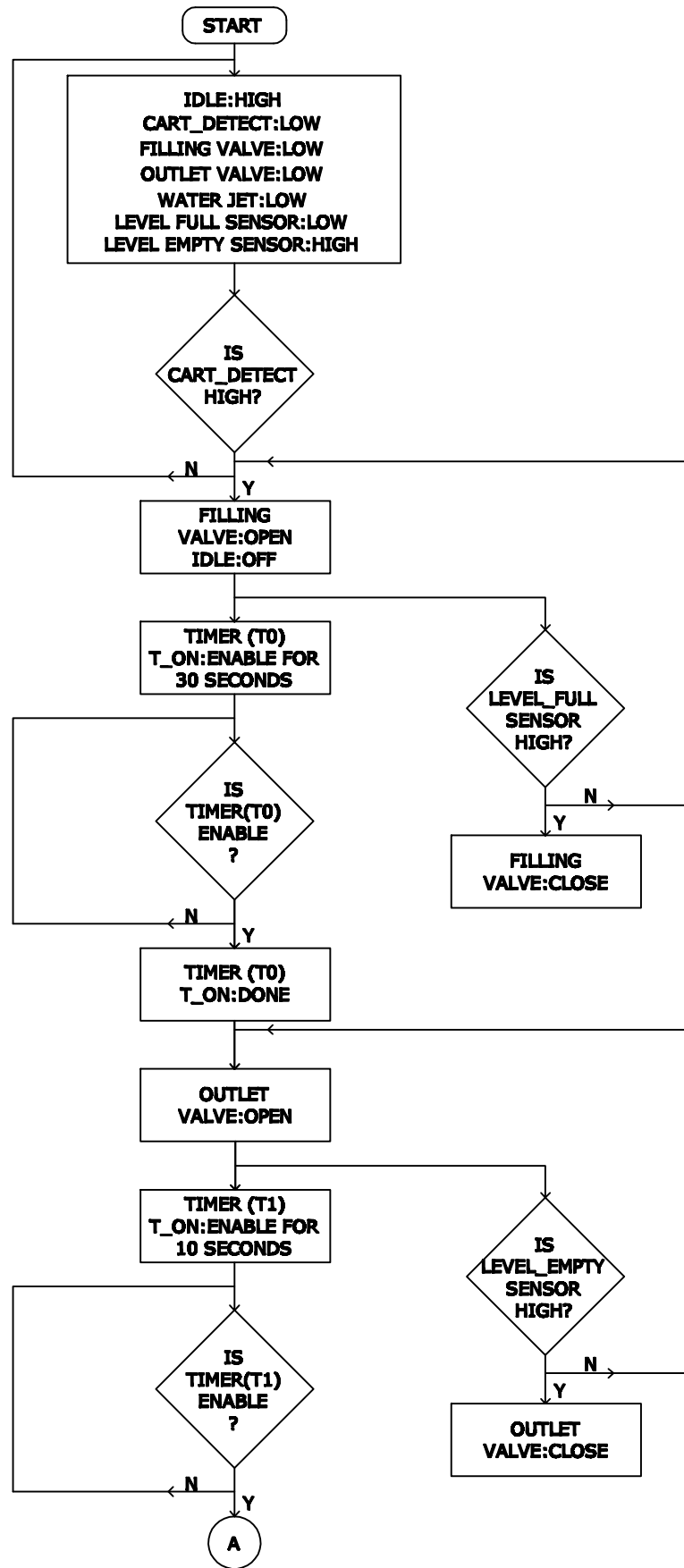
System component

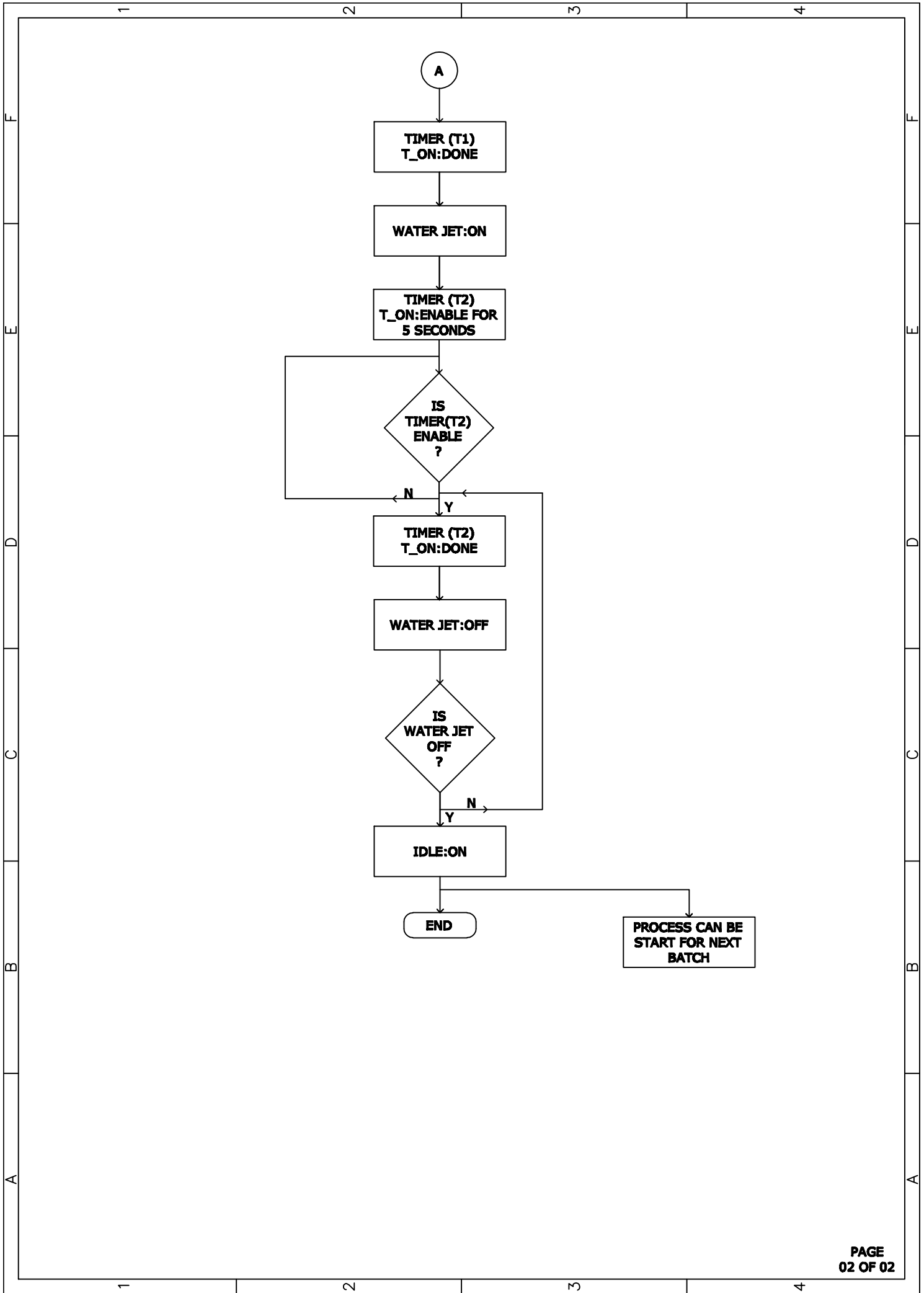
- 1.A cart detect limit switch
- 2.Two solenoid operated valve(one is filling valve and other is outlet valve)
- 3.two sensor(one is level full sensor and other is level empty sensor)
- 4.Three timer

Control philosophy

- The process starts in idle.
- The cart detect limit switch opens the filling valve.
- After a delay of 30 seconds from the opening of the filling valve, the outlet valve opens.
- When the tanks is full (*level full sensor: healthy*) the filling valve closes.
- When the tank is empty (*level empty sensor: healthy*) the outlet valve closes.
- After a delay of 10 second from the opening of the outlet valve, a water jet opens.
- After a delay of 2 second, the water jet closes and the process returns to the 'idle' state.

PROCESS FLOW CHART OF WATER CONTROL SYSTEM LOGIC OPERATION

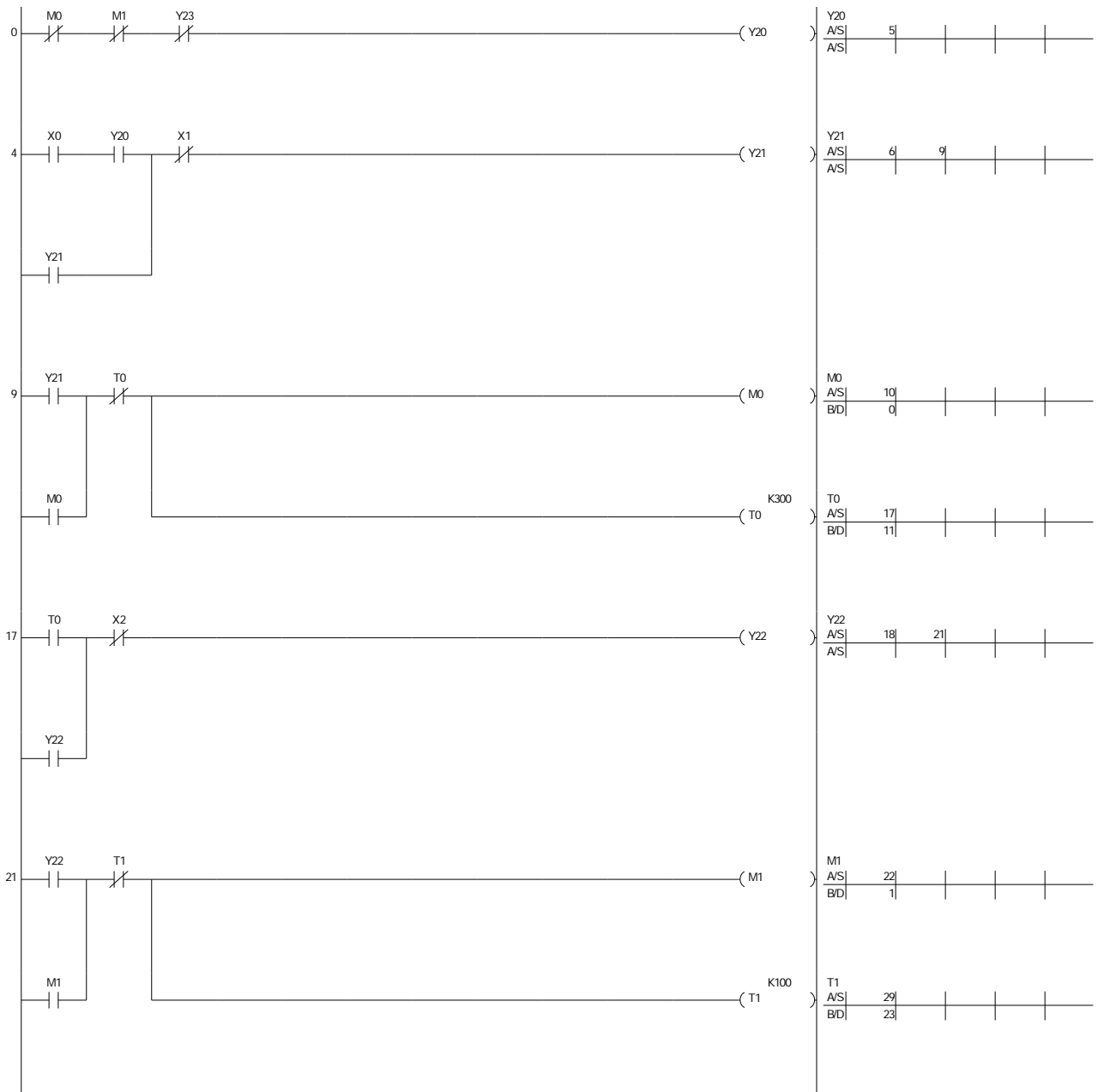




Ladder Diagram

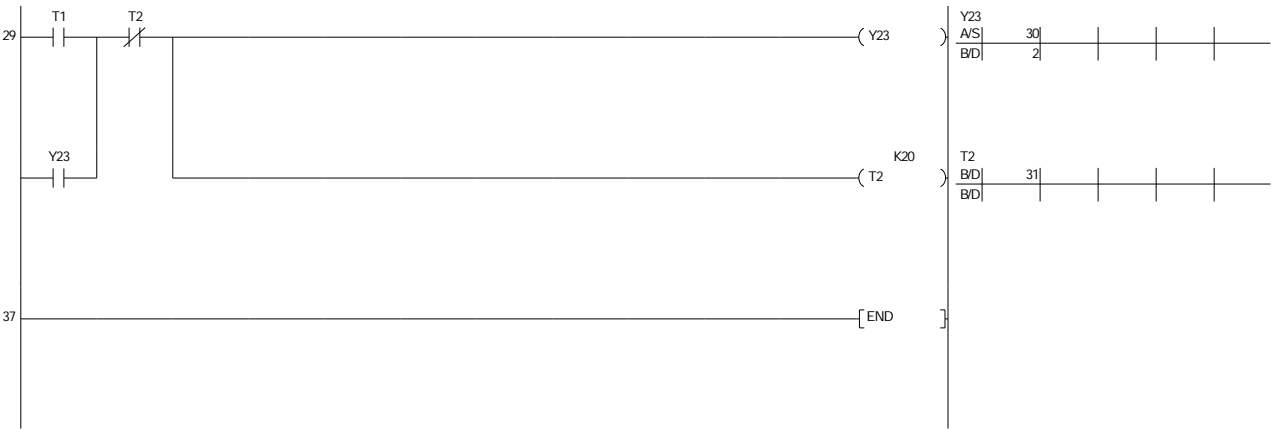
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Library Name:-
Data Name:MAIN

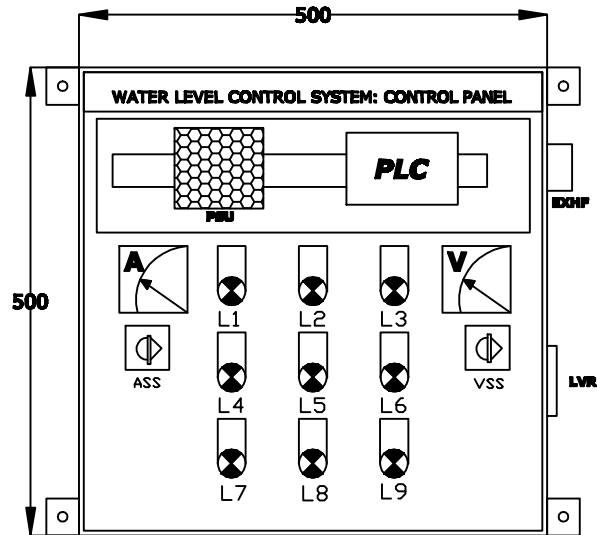
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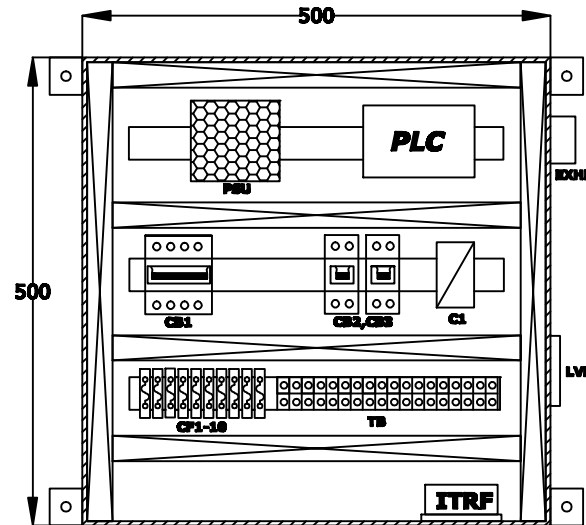
Program
Library Name:-
Data Name:MAIN

12/29/2014

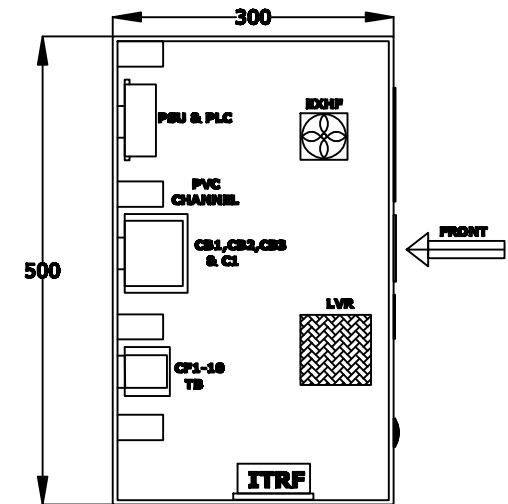




A. FRONT VIEW





B. INSIDE FRONT VIEW

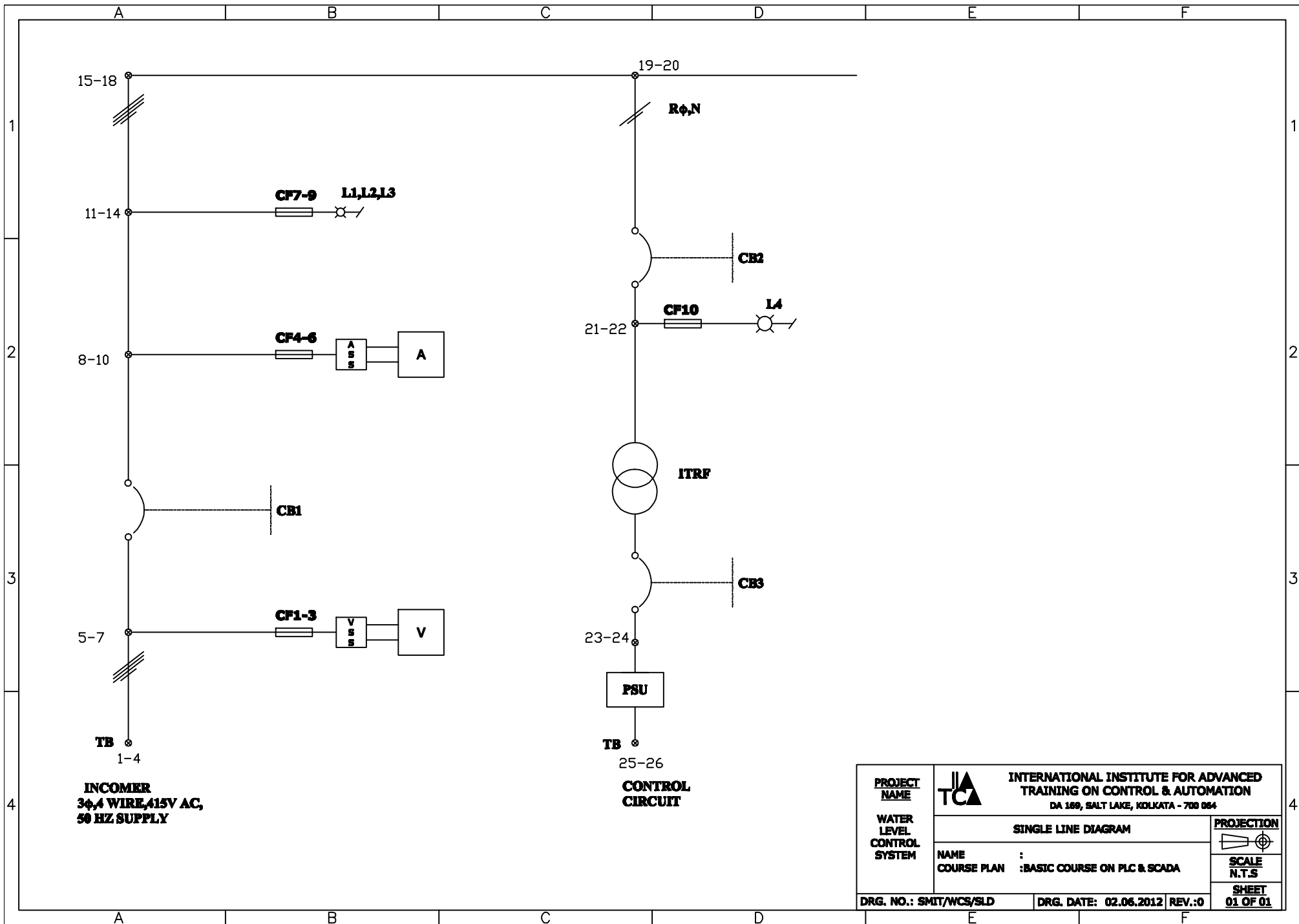


C. SIDE VIEW

ALL DIMENSIONS ARE IN MM.



| | | |
|--|--|---|
| PROJECT NAME WATER LEVEL CONTROL SYSTEM |  INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION DA 169, SALT LAKE, KOLKATA - 700 064 | |
| | GENERAL ARRANGEMENT OF CONTROL PANEL | |
| | NAME : COURSE PLAN : | PROJECTION  SCALE 1:5 SHEET 01 OF 01 |
| | DRG. NO.: SMIT/WCS/GA | DRG. DATE: 02.06.2012 REV.: 0 |

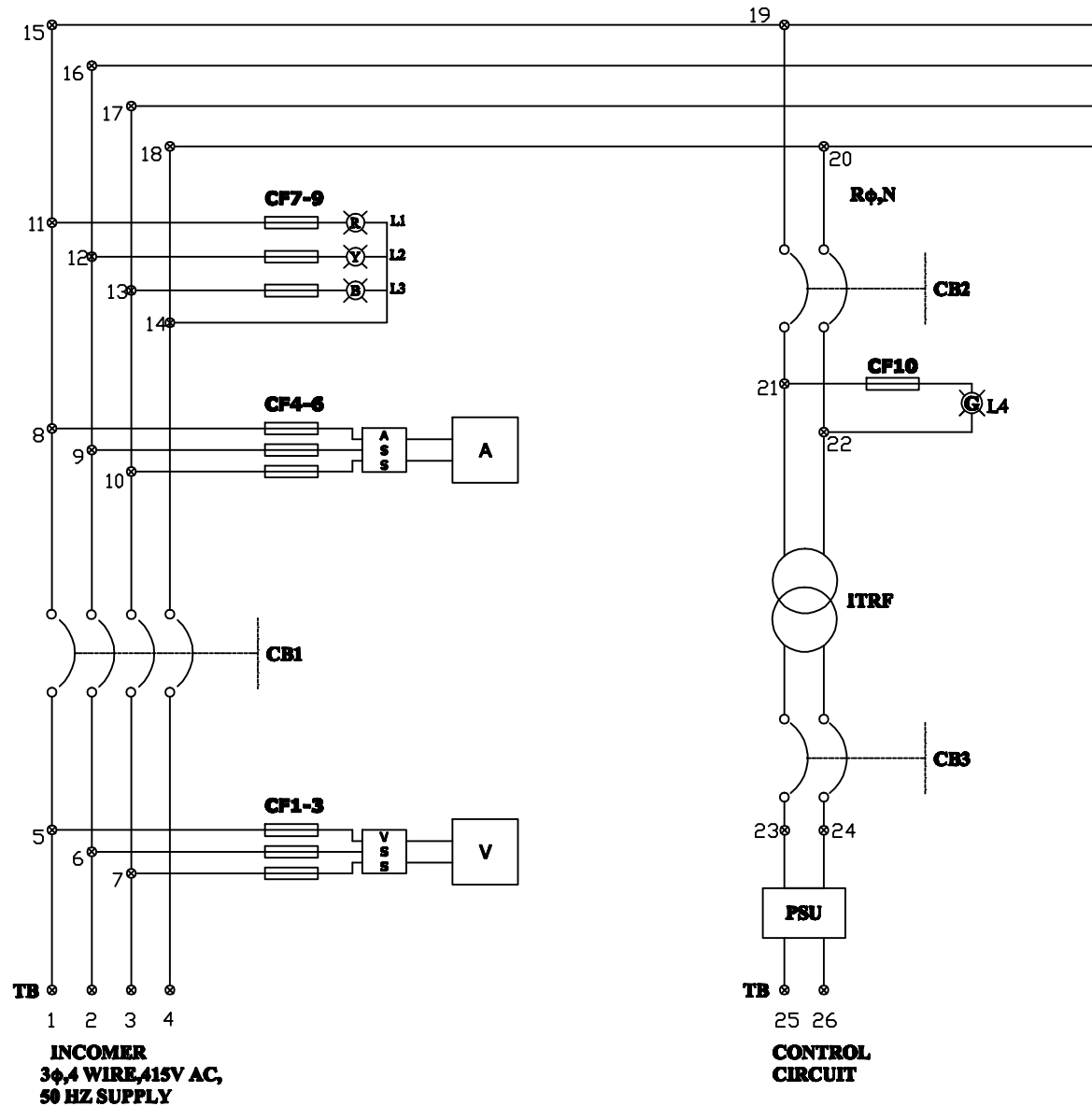
| LEGEND DETAILS | | | | | | |
|----------------|------------|---|-------------------------------------|--|-------------------|--------|
| Sl. No. | Tag | Material Description | Range/Rating | Type | Make | Qty. |
| 1 | PLC | Programmable Logic Controller (CPU) | I/P:32 nos;O/P:32 nos | Transistor | Mitsubishi | 1 |
| 2 | | PC -> PLC Communication Port | Ethernet | E-436709(ETL) | Belkin | 1 |
| 3 | PSU | Power Supply Unit | 6A | I/P: 100/240V AC; O/P: 5V DC,6A | Mitsubishi | 1 |
| 4 | ITRF | Isolation Transformer | 5VA; CTR-1:1 | I/P: 120/230V AC; O/P: 120/230V AC | Gupta Engg. | 1 |
| 5 | CB1 | TPN / FP | 63A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 1 |
| 6 | CB2, CB3 | DP | 10A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 2 |
| 7 | C1 | Contactor | 10A, 230V AC | with (3NO+1NC) Aux. contact | Telemecanique | 1 |
| 8 | A | Ammeter | 0 - 100A | Analog, Direct reading; Size: 72 mm ² | Meco | 1 |
| 9 | ASS | Ammeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 |
| 10 | V | Voltmeter | 0 - 500V | Analog; Size: 72 mm ² | Meco | 1 |
| 11 | VSS | Voltmeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 |
| 12 | CF1 - CF10 | Control Fuse | 2A, 140W | with Base mtg. | GEC | 10 |
| 13 | L1 - L7 | Panel Indicating Lamp; Red, Green -2 nos. each & Orange, Yellow, Blue -1 no. each | 230V AC | Filament type | Siemens | 7 |
| 14 | LVR | Louver | Size: 150 mm ² | Mesh type | Keyman | 1 |
| 15 | EXHF | Exhaust fan | Size: 4"; 230V AC | Ventilation type | Rexnord | 1 |
| 16 | CFL | Compact Fluorescent Lamp | 12W / 230V AC | Colour: White | Philips | 1 |
| 17 | DLS | Door Limit Switch | 6A | | Essen | 1 |
| 18 | TB | Terminal Block | Size: 2.5 mm ² | Clip-on type | Elmex | Bulk |
| 19 | | Cu. Wires | 1100V/660V, 2.5 mm ² | PVC Insulated, Multistranded FRP Flexible | Finolex | 1 coil |
| 20 | | Transparent Perspex Sheet | 200 mm.(H) × 200 mm.(W) | 1.2mm.Thk; Scratch proof | Siant-Gobain | 1 |
| 21 | | Hardwares (PVC Channel, DIN Rail, Nut, Bolt, Screw, Washer, Cable Tie, Lugs, Rubber Gasket, Ferrules, Groomet, Earthing Stud, Door Knob, Nameplate, Terminal Endplate etc.) | Various size | Various type | Reputed | Bulk |
| 22 | | Control Box | [H×W×D]: 500 mm.×500 mm.×300 mm. | Wall Mounting; IP-54; | Fabcon Technology | 1 |




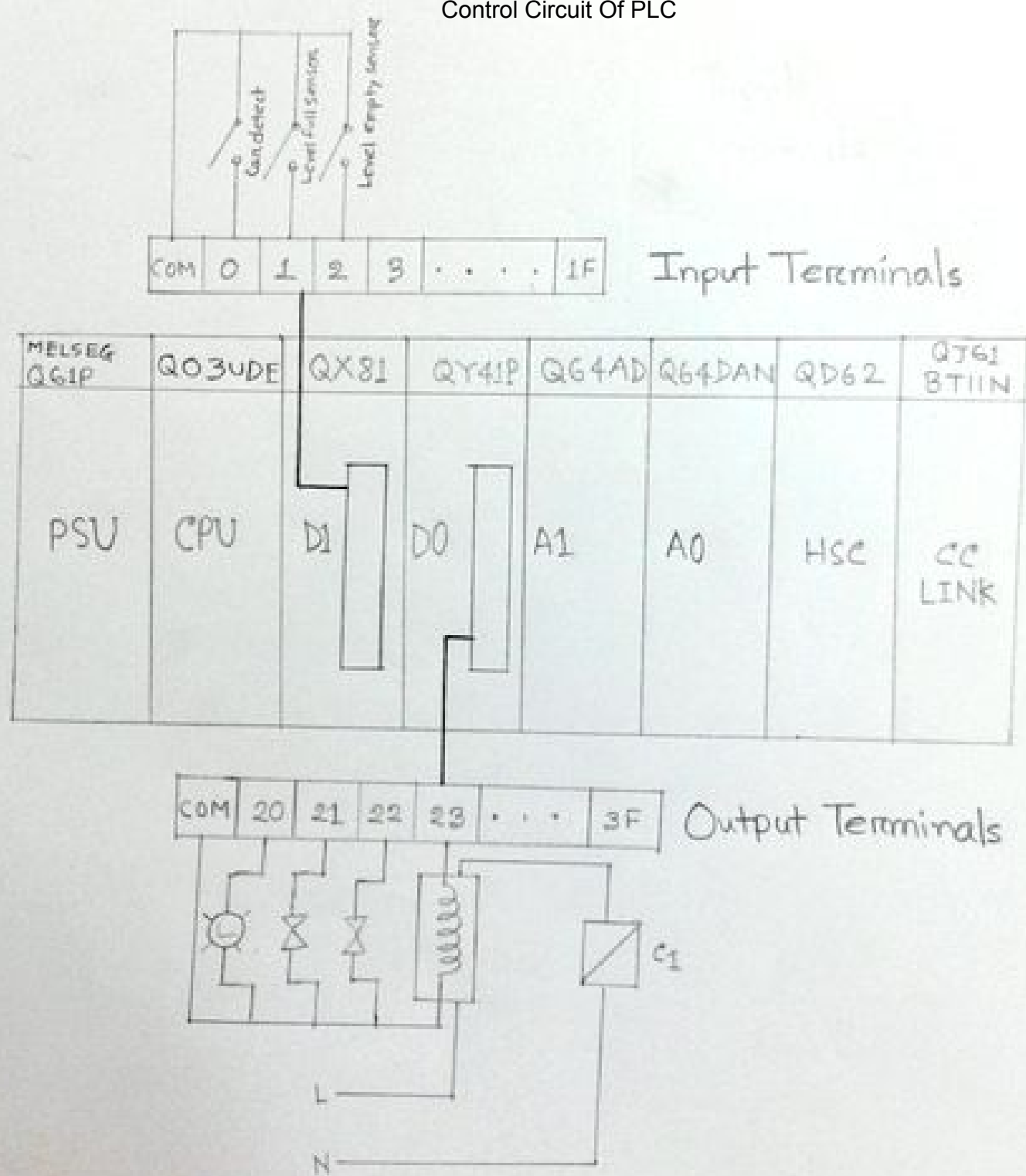
INCOMER
3 ϕ ,4 WIRE,415V AC,
50 HZ SUPPLY

CONTROL CIRCUIT

| | | |
|--|--|---|
| PROJECT NAME WATER LEVEL CONTROL SYSTEM |  INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION DA 169, SALT LAKE, KOLKATA - 700 064 | |
| | SINGLE LINE DIAGRAM | |
| | NAME : COURSE PLAN :BASIC COURSE ON PLC & SCADA | PROJECTION  SCALE N.T.S |
| | DRG. NO.: SMIT/WCS/SLD | DRG. DATE: 02.06.2012 REV.:0 SHEET 01 OF 01 |



| | | |
|--|--|---|
| PROJECT NAME WATER LEVEL CONTROL SYSTEM | INTERNATIONAL INSTITUTE FOR ADVANCED TRAINING ON CONTROL & AUTOMATION DA 169, SALT LAKE, KOLKATA - 700 064 | |
| | POWER CIRCUIT | |
| | NAME : COURSE PLAN : | PROJECTION  SCALE N.T.S SHEET 01 OF 01 |
| | DRG. NO.: SMIT/WCS/PC_M | DRG. DATE: 02.06.2012 REV.: 0 |



| BILL OF MATERIAL | | | | | |
|------------------|---|-------------------------------------|--|-------------------|--------|
| Sl. No. | Material Description | Range/Rating | Type | Make | Qty. |
| 1 | Programmable Logic Controller (CPU) | I/P:32 nos;O/P:32 nos | Transistor | Mitsubishi | 1 |
| 2 | PC -> PLC Communication Port | Ethernet | E-436709(ETL) | Belkin | 1 |
| 3 | Power Supply Unit | 6A | I/P: 100/240V AC; O/P: 5V DC ,6A | Mitsubishi | 1 |
| 4 | Isolation Transformer | 5VA; CTR-1:1 | I/P: 120/230V AC; O/P: 120/230V AC | Gupta Engg. | 1 |
| 5 | TPN / FP | 63A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 1 |
| 6 | DP | 10A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 2 |
| 7 | Contactora | 10A, 230V AC | with (3NO+1NC) Aux. contact | Telemecanique | 1 |
| 8 | Ammeter | 0 - 100A | Analog, Direct reading; Size: 72 mm ² | Meco | 1 |
| 9 | Ammeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 |
| 10 | Voltmeter | 0 - 500V | Analog; Size: 72 mm ² | Meco | 1 |
| 11 | Voltmeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 |
| 12 | Control Fuse | 2A, 140W | with Base mtg. | GEC | 10 |
| 13 | Panel Indicating Lamp; Red, Green -2 nos. each & Orange, Yellow, Blue -1 no. each | 230V AC | Filament type | Siemens | 7 |
| 14 | Louver | Size: 150 mm ² | Mesh type | Keyman | 1 |
| 15 | Exhaust fan | Size: 4": 230V AC | Ventilation type | Rexnord | 1 |
| 16 | Compact Fluorescent Lamp | 12W / 230V AC | Colour: White | Philips | 1 |
| 17 | Door Limit Switch | 6A | | Essen | 1 |
| 18 | Terminal Block | Size: 2.5 mm ² | Clip-on type | Elmex | Bulk |
| 19 | Cu. Wires | 1100V/660V, 2.5 mm ² | PVC Insulated, Multistranded FRP Flexible | Finolex | 1 coil |
| 20 | Transparent Perspex Sheet | 200 mm.(H) × 200 mm.(W) | 1.2mm.Thk; Scratch proof | Siant-Gobain | 1 |
| 21 | Hardwares (PVC Channel, DIN Rail, Nut, Bolt, Screw, Washer, Cable Tie, Lugs, Rubber Gasket, Ferrules, Groomet, Earthing Stud, Door Knob, Nameplate, Terminal Endplate etc.) | Various size | Various type | Reputed | Bulk |
| 22 | Control Box | [H×W×D]: 500 mm.×500 mm.×300 mm. | Wall Mounting; IP-54; | Fabcon Technology | 1 |
| | | | | | |
| | | | | | |

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:

$$= 2[(0.5 \times 0.5) + (0.5 \times 0.3) + (0.3 \times 0.5)] \text{ sq.m.}$$

$$= 2[0.25 + 0.15 + 0.15] \text{ sq.m.}$$

$$= 2 \times 0.55 \text{ sq. m.}$$

$$= 1.1 \text{ sq. m.}$$

B] Mounting plate of the control panel:

$$= 350 \text{ mm.} \times 400 \text{ mm.}$$

$$= 0.35 \text{ m} \times 0.4 \text{ m.}$$

$$= 0.14 \text{ sq. m.}$$

Total Sheet Metal required for control panel [A+B]:

$$= (1.1 + 0.14) \text{ sq.m.} \times 16 \text{ kg.}$$

[Since, Weight of 2 mm. CRCA: 16 kg/m²]

$$= 1.24 \text{ sq.m} \times 16 \text{ k.g} = 19.84 @ \text{ Rs. 180/-}$$

[Cost includes sheet metal cost, transportation, fabrication, painting, electricity, packing, forwarding, labor charge etc.]

$$= \text{Rs. 3572/-}$$

Say: Rs. 5000/-

[Rupees Five Thousand only]

| COST ANALYSIS | | | | | | | |
|--|---|----------------------------------|--|-------------------|--------|---------------------|----------------------|
| Sl. No. | Material Description | Range/Rating | Type | Make | Qty. | Unit Price (in Rs.) | Total Price (in Rs.) |
| 1 | Programmable Logic Controller (CPU) | I/P:32 nos;O/P:32 nos | Transistor | Mitsubishi | 1 | 31,000.00 | 31,000.00 |
| 2 | PC -> PLC Communication Port | Ethernet | E-436709(ETL) | Belkin | 1 | | |
| 3 | Power Supply Unit | 6A | I/P: 100/240V AC; O/P: 5V DC ,6A | Mitsubishi | 1 | 1,250.00 | 1,250.00 |
| 4 | Isolation Transformer | 5VA; CTR-1:1 | I/P: 120/230V AC; O/P: 120/230V AC | Gupta Engg. | 1 | 1,400.00 | 1,400.00 |
| 5 | TPN / FP | 63A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 1 | 2,500.00 | 2,500.00 |
| 6 | DP | 10A, Breaking Capacity: 6kA | C Curve; Isolator type | L&T | 2 | 450.00 | 900.00 |
| 7 | Contactora | 10A, 230V AC | with (3NO+1NC) Aux. contact | Telemecanique | 1 | 500.00 | 500.00 |
| 8 | Ammeter | 0 - 100A | Analog, Direct reading; Size: 72 mm ² | Meco | 1 | 650.00 | 650.00 |
| 9 | Ammeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 | 150.00 | 150.00 |
| 10 | Voltmeter | 0 - 500V | Analog; Size: 72 mm ² | Meco | 1 | 650.00 | 650.00 |
| 11 | Voltmeter Selector Switch | 6A | 4 position (with Off) | Kaycee | 1 | 150.00 | 150.00 |
| 12 | Control Fuse | 2A, 140W | with Base mtg. | GEC | 10 | 25.00 | 250.00 |
| 13 | Panel Indicating Lamp; Red, Green -2 nos. each & Orange, Yellow, Blue -1 no. each | 230V AC | Filament type | Siemens | 7 | 155.00 | 1,085.00 |
| 14 | Louver | Size: 150 mm ² | Mesh type | Keyman | 1 | 150.00 | 150.00 |
| 15 | Exhaust fan | Size: 4"; 230V AC | Ventilation type | Rexnord | 1 | 350.00 | 350.00 |
| 16 | Compact Fluroscnt Lamp | 12W / 230V AC | Colour: White | Philips | 1 | 150.00 | 150.00 |
| 17 | Door Limit Switch | 6A | | Essen | 1 | 150.00 | 150.00 |
| 18 | Terminal Block | Size: 2.5 mm ² | Clip-on type | Elmex | Bulk | 500.00 | 500.00 |
| 19 | Cu. Wires | 1100V/660V, 2.5 mm ² | PVC Insulated, Multistranded FRP Flexible | Finolex | 1 coil | 2,500.00 | 2,500.00 |
| 20 | Transparent Perspex Sheet | 200 mm.(H) × 200 mm.(W) | 1.2mm.Thk; Scratch proof | Siant-Gobain | 1 | 500.00 | 500.00 |
| 21 | Hardwares (PVC Channel, DIN Rail, Nut, Bolt, Screw, Washer, Cable Tie, Lugs, Rubber Gasket, Ferrules, Groomet, Earthing Stud, Door Knob, Nameplate, Terminal Endplate etc.) | Various size | Various type | Reputed | Bulk | 2,500.00 | 2,500.00 |
| 22 | Control Box | [H×W×D]: 500 mm.×500 mm.×300 mm. | Wall Mounting; IP-54; | Fabcon Technology | 1 | 5,000.00 | 5,000.00 |
| TOTAL COST: | | | | | | | 39,285.00 |
| (Rupees Thirty Nine Thousand Two Hundred & Eightyfive Only.) | | | | | | | |

(Rupees Thirty Nine Thousand Two Hundred & Eightyfive Only.)

Conclusion

I have finished my project successfully by using PLC effectively. PLC reduces the complex circuitry of the entire control system. I'm able to eliminate the high cost associated with relay controlled system by using it. Also the entire control system becomes easy for maintenance and troubleshooting.