



IoT Based Programmable Resistive Load Bank

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What Are Load Banks And What Are They Used For?



What is a Load Bank?

- A Load Bank is a device which develops an electrical load, applies the load to an electrical power source and converts or dissipates the resultant power output of the source.
- A Load Bank is intended to accurately mimic the operational load which a power source will see in actual application.



Types of Load Banks

- **Resistive Load Banks:** provides equivalent loading of both generator and prime mover
- **Reactive Load Banks:** includes inductive (lagging power factor) and/or capacitive (leading power factor) loads
 - Inductive Load Banks
 - Capacitive Load Banks
- **Resistive/Reactive Load Banks**



Applications of Load Banks

Load Banks can be used for several purposes, including:

- Manufacturing Testing
 - Generator Test Cells
 - Engine Test Cells
- Field Testing & Exercise
- Elimination of Wet Stacking
- Demonstration

Project Description



Problem Statement

Design a three phase variable resistive load bank with a maximum capacity of 12kW and 10 step control.



Milestones Completed

- Voice of Customer Document
- Basic Block Diagram
- Detailed Block Diagram
- Process Flow Chart
- **Schematic Diagram**
- **Wiring Diagram**
- **Bill of Materials**
- **Detailed Simulation on LabVIEW**

VOC (Voice of Customer)

Three phase variable resistive load bank with 12kW maximum capacity and 10 variable step control.

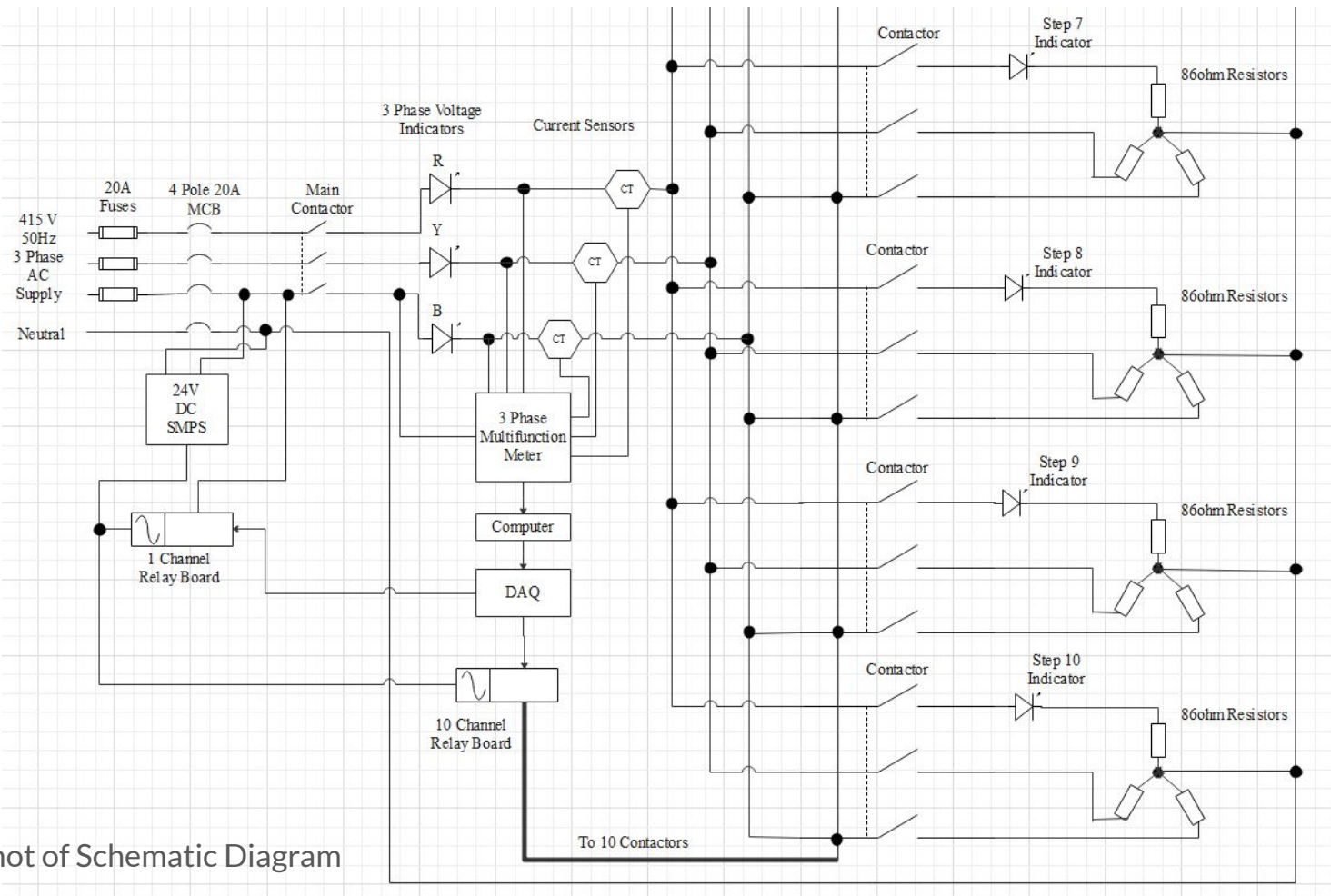
SI no	Customer requirement	Input	Output
1	Step 1	3x 690 Ω resistors (90W rating)	250W, 0.35A
2	Step 2	3x 690 Ω resistors (90W rating)	250W, 0.35A
3	Step 3	3x 344 Ω resistors (175W rating)	500W, 0.70A
4	Step 4	3x 172 Ω resistors (500W rating)	1kW, 1.39A
5	Step 5	3x 172 Ω resistors (500W rating)	1kW, 1.39A

5	Step 5	3x 172 Ω resistors (500W rating)	1kW, 1.39A
6	Step 6	3x 172 Ω resistors (500W rating)	1kW, 1.39A
7	Step 7	3x 86 Ω resistors (750W rating)	2kW, 2.78A
8	Step 8	3x 86 Ω resistors (750W rating)	2kW, 2.78A
9	Step 9	3x 86 Ω resistors (750W rating)	2kW, 2.78A
10	Step 10	3x 86 Ω resistors (750W rating)	2kW, 2.78A

Equal steps can also be triggered for the following loads.

Equal Steps	Load per Step	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
2	6000	1,2,3,4, 5,6,7	8,9,10				
3	4000	1,2,3,4, 5,6	7,8	9,10			
4	3000	1,2,3,7	4,8	5,9	6,10		
6	2000	1,2,3,4	5,6	7	8	9	10

Schematic and Wiring Diagram



Snapshot of Schematic Diagram

Snapshot of Wiring Diagram - 1

415 V
50Hz
3 Phase
AC
Supply

Neutral

20A
Fuses

4 Pole 20A
MCB

Main
Contactor

3 Phase Voltage
Indicator

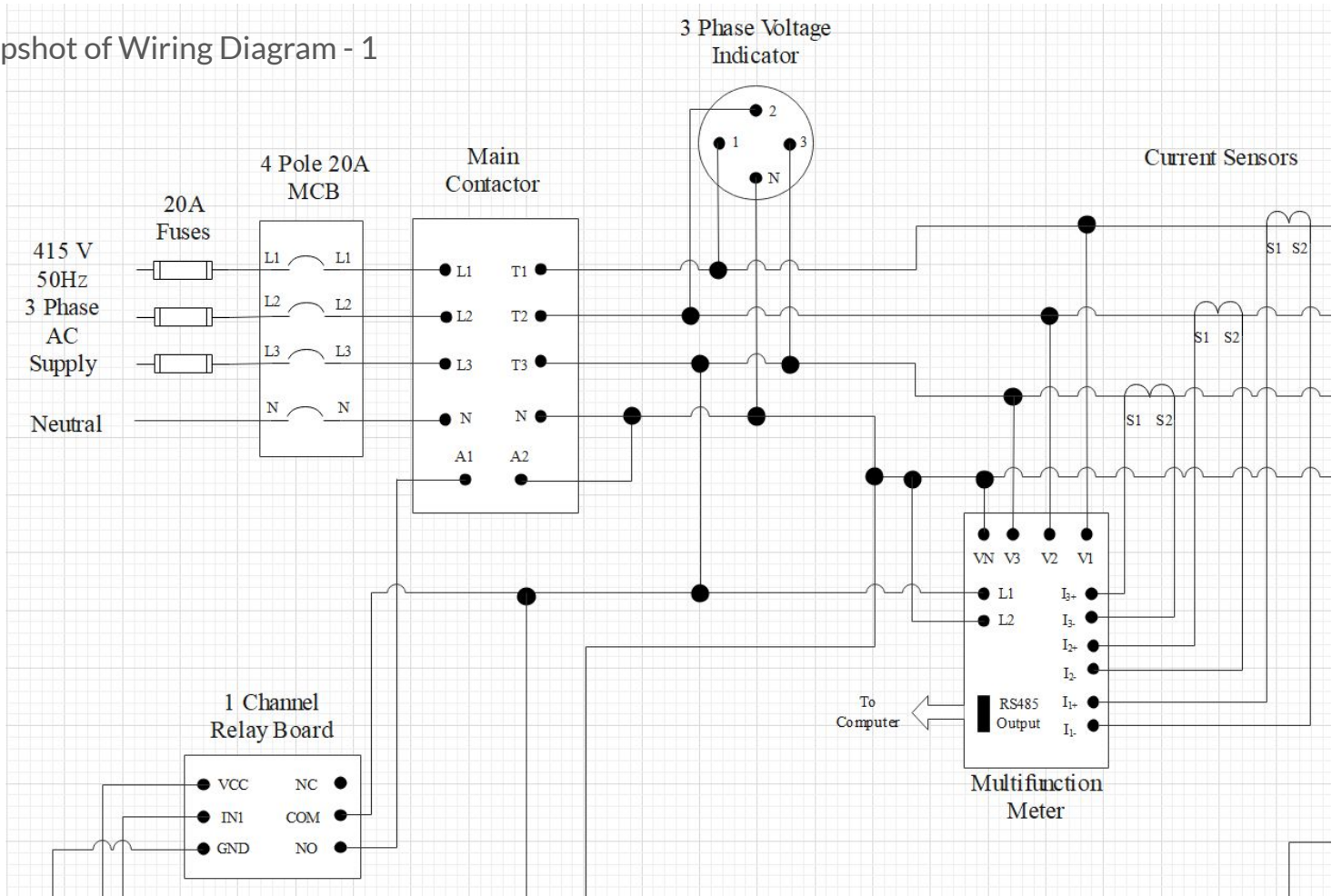
Current Sensors

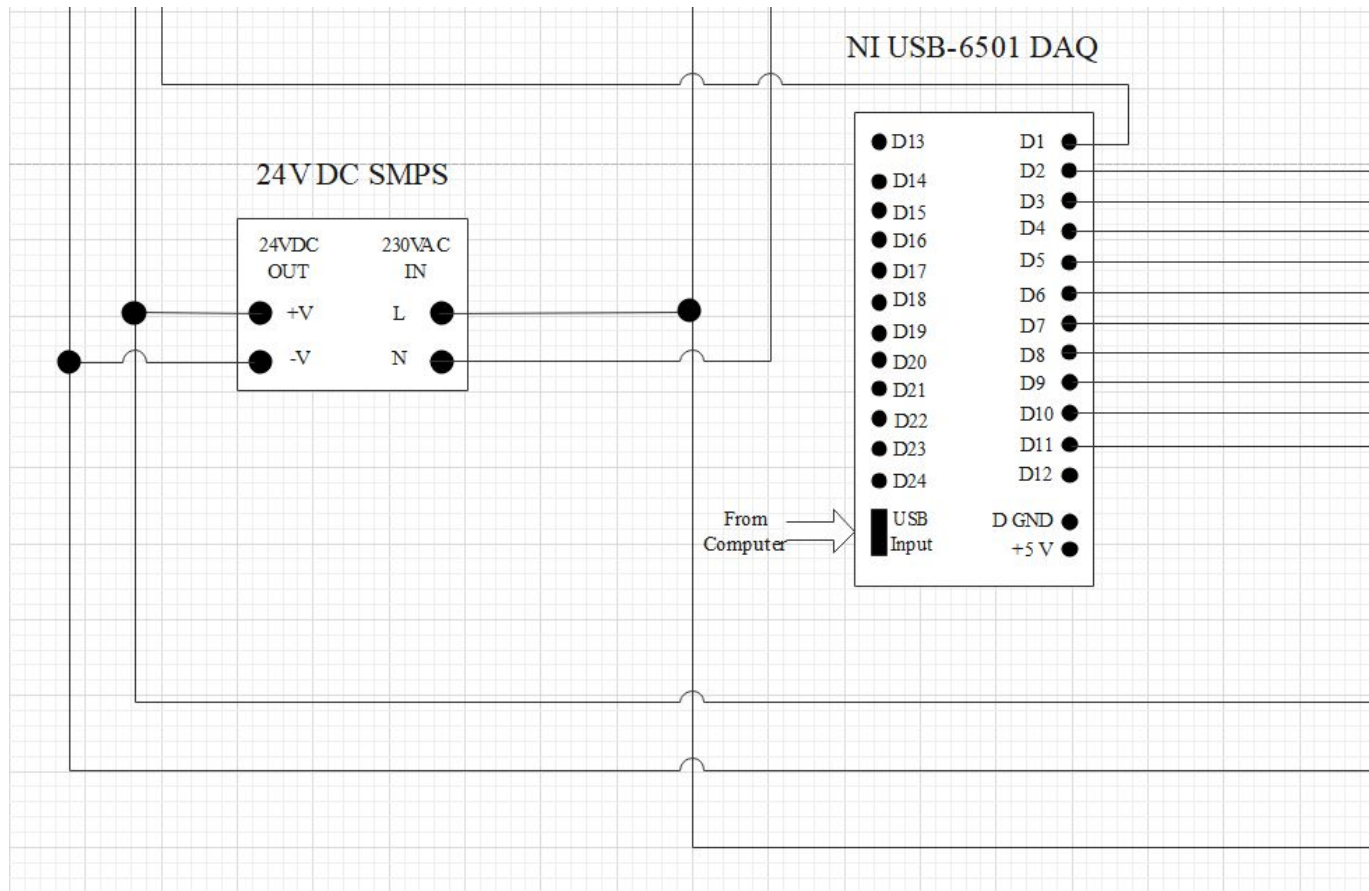
1 Channel
Relay Board

Multifunction
Meter

To
Computer

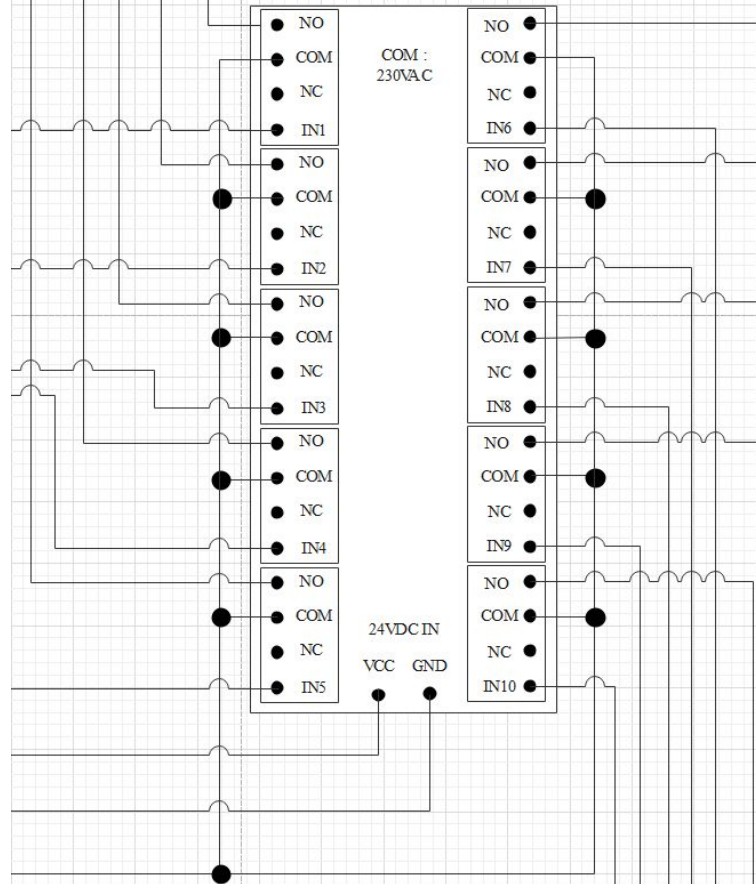
RS485
Output



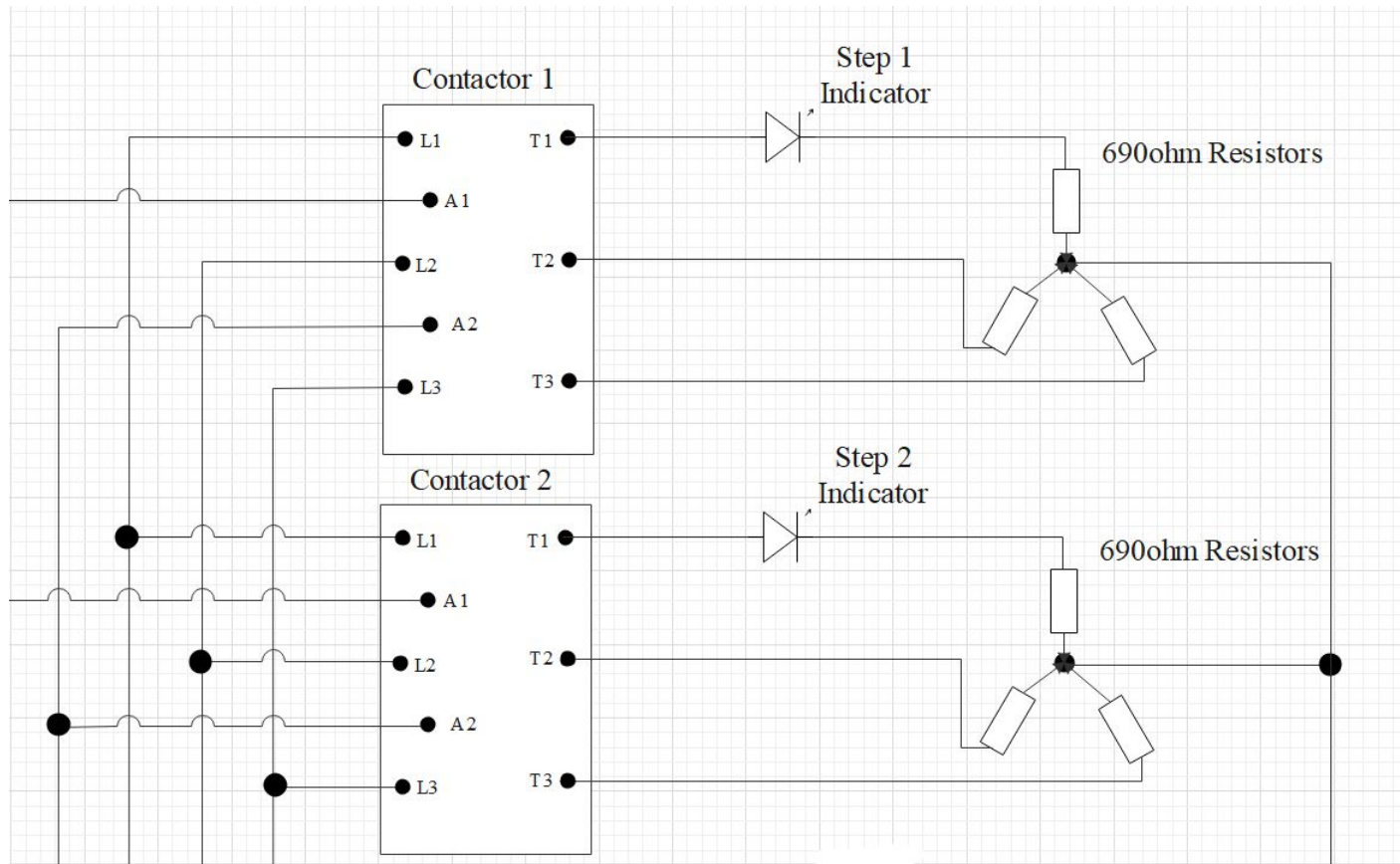


Snapshot of Wiring Diagram - 2

10 Channel Relay Board







Snapshot of Wiring
Diagram - 3



Snapshot of Wiring Diagram - 4

Bill of Materials





ELECTR•NO

Sl.No	Category	Components	Description/Specifications	Qty	Unit Cost	Total Cost	Vendor Details	Reference
1	Power Supply	24V SMPS	NHP 24V 3A 72W Switch Mode Power Supply	1	₹959.00	₹959.00	Robu.in https://robu.in/product/nhp-24v-3a-72	
2	Protective Devices	Fuse	SKYU Bakelite Kit Kat Fuse, 20A 250VAC	3	₹80.00	₹240.00	Indiamart https://www.indiamart.com/proddetail	
3		MCB	Havells MCB FP D CURVE 20 A 4 Pole	1	₹1,760.00	₹1,760.00	Havells https://www.havells.com/en/consume	
4		3 Phase Voltage Indicator	Schneider Electric Pilot light 3 phases voltage, indicator with 3 LED, white, 400 V AC	1	₹17,716.12	₹17,716.12	Element 14 https://in.element14.com/schneider-el	





Snapshot of Bill of Materials - 1

5	Contactors	Main Contactor	Schneider Electric EasyPact TVS contactor 3P(3 NO) - AC-3 - <= 440 V 18A - 415 V AC coil	1	₹801.00	₹801.00	industrybuying.com	
							https://www.industrybuying.com/contactors	
6	Contactors	Branch Contactor	Schneider Electric EasyPact TVS contactor 3P(3 NO) - AC-3 - <= 440 V 6A - 415 V AC coil	10	₹611.00	₹6,110.00	industrybuying.com	
							https://www.industrybuying.com/contactors	
7	Relay Boards	Single Channel Relay	SPDT channel relay with 24VDC power supply and 42mA current consumption	1	₹129.00	₹129.00	Robu.in	
							https://robu.in/product/24v-1-channel-relay-board/	
8	Relay Boards	10 Channel Relay	10 SPDT channel relay board with 24VDC power supply and 210mA current consumption	1	₹2,009.06	₹2,009.06	Denkovi Assembly Electronics	
							http://denkovi.com/relay-card-24v-10-channel/	

Snapshot of Bill of Materials - 2

9	Data Acquisition	DAQ	NI USB-6501 24-Channel, 8.5 mA, Digital I/O Device	1	₹9,400.00	₹9,400.00	National Instruments https://www.ni.com/en-in/shop/select	
10		Multifunction Meter	Schneider Electric EasyLogic PM2130, Power & Energy meter, up to 31stH, LED, RS485, class 0.5S	1	₹23,622.63	₹23,622.63	Nex Instruments https://www.nexinstrument.com/METS	
11		Current Sensor	Schneider Electric Current transformer tropicalised DIN mount 40 5 for cables d. 21	3	₹2,999.90	₹8,999.70	Elect Go https://sg.electgo.com/products/METS	
12	Indicators	LED Indicators for Individual Steps	LED PANEL INDICATOR 230V 22MM	10	₹335.00	₹3,350.00	Tsktech.in https://www.tsstech.in/product/led-pa	

Snapshot of Bill of Materials - 3

13	Resistors	690 ohm (90W)	Vishay Wirewound Resistors, Industrial Power, Tubular, Roundwire (RD), Fixed (RDEF, RDSF) RDEF0090	6			Vishay https://www.vishay.com/resistors-fixe	
14		344 ohm (175W)	Vishay Wirewound Resistors, Industrial Power, Tubular, Roundwire (RD), Fixed (RDEF, RDSF) RDEF0175	3			Vishay https://www.vishay.com/resistors-fixe	
15		172 ohm (500W)	Vishay Wirewound Resistors, Industrial Power, Tubular, Roundwire (RD), Fixed (RDEF, RDSF) RDSF0500	9			Vishay https://www.vishay.com/resistors-fixe	
16		86 ohm (750W)	Vishay Wirewound Resistors, Industrial Power, Tubular, Roundwire (RD), Fixed (RDEF, RDSF) RDSF0750	12			Vishay https://www.vishay.com/resistors-fixe	

Snapshot of Bill of Materials - 4

17	Cables	24A Thick Cable	Havells 2.5 sqmm 10 core Copper Armoured Control Cable	20	₹275.00	₹5,500.00	Best of Electricals	
							https://www.bestofelectricals.com/hav	
18	Cables	12A Thin Cable	Havells 1 sq mm 3 Core 100 mtr Flexible Wire	1	₹3,740.00	₹3,740.00	Best of Electricals	
							https://www.bestofelectricals.com/hav	
19	Connectors	Banana Plugs	4mm Banana Shrouded Socket	10	₹56.00	₹560.00	Indiamart	
							https://www.indiamart.com/proddetail	

Snapshot of Bill of Materials - 5

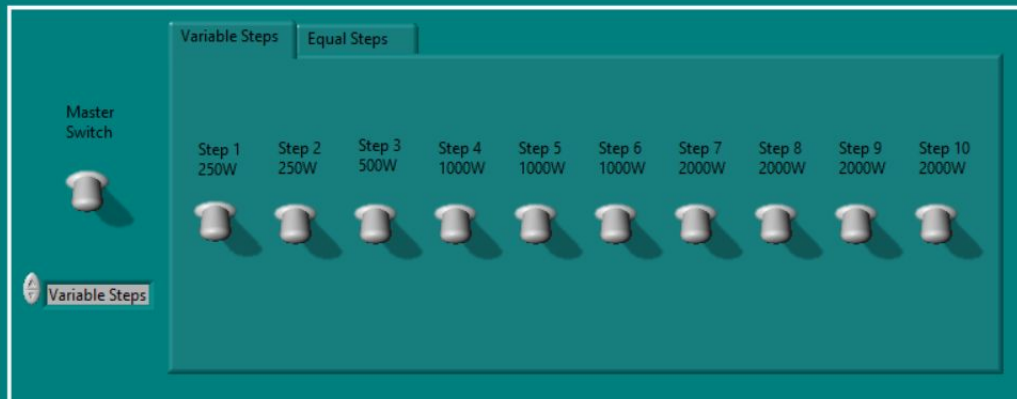
20	Hardware Components	Cooling Fan	Rexnord REC 22038 4 x 4 inch Axial Fan	2	₹406.00	₹812.00	Industry Buying	
						https://www.industrybuying.com/exha		
21		Cable duct	Pre-Galvanized Electric Cable Tray Size: custom	1	₹800.00	₹800.00	Indiamart	
						https://www.indiamart.com/proddetail		
22		Din Rail	Steel Din Rail Channels				Indiamart	
						https://www.indiamart.com/proddetail		
23		Ring Lugs	Dowell's Ring Terminals Lugs 16-12 Sq.Mm	20	₹0.11	₹2.20	Indiamart	
						https://www.indiamart.com/proddetail		

Snapshot of Bill of Materials - 6

LabVIEW Simulation

Three Phase Variable Resistive Load Bank with 12kW Maximum Capacity and 10 Step Control

All resistors are connected in 3 phase star formation



Stop

Voltage (V)

0

Current (A)

0.0000

Load (kW)

0

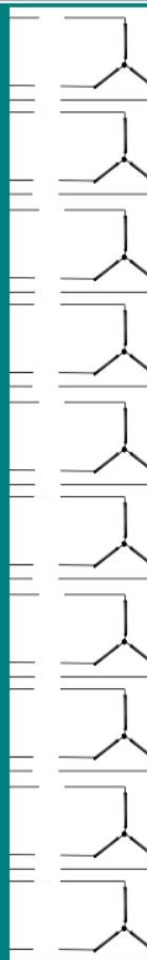
No. of Resistors Used

0

Each Resistor Looks Like This



Step 1 Indicator
Step 2 Indicator
Step 3 Indicator
Step 4 Indicator
Step 5 Indicator
Step 6 Indicator
Step 7 Indicator
Step 8 Indicator
Step 9 Indicator
Step 10 Indicator



Front Panel



Conclusion

- Understanding of Load Banks
- Various steps in a technical project
- Glimpse into professional electrical industry