

# **PROJECT**

## **1.1 Automation of power systems through SCADA**

Aim: The aim of the project is to control the 3 ph-Induction motors (star delta contactors) through the PLC-SCADA system.

### **The Technologies are used:**

Project was developed in Siemens PLC and the SCADA system was WinCC 6.4

Details are given below:

PLC	:	S7-315 2 PN/DP
Communication	:	Profibus
PLC Coding software	:	Step7 5.5
Coding Language	:	Ladder Logic
SCADA	:	WinCC 7.4
Communication	:	Ethernet TCP/IP
OS	:	Windows 10 pro

### **Programmable Logic Controller (PLC):**

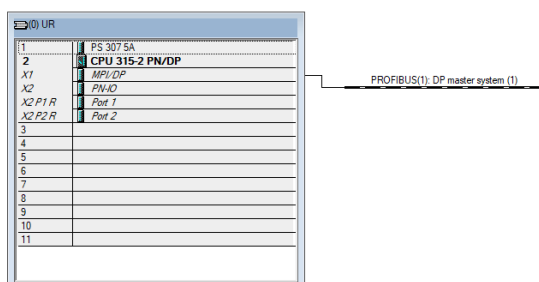
This was very popular CPU which is very rugged for industrial mid-range applications

### **Technical specifications of PLC:**

Model No: 6ES7 315-2EH14-0AB0

384 KB work memory; 0.05ms/1000 instructions; PROFINET connection; S7 Communication (loadable FBs/FCs); PROFINET IO-Controller; supports RT/IRT; PROFINET interface and 2 ports; MRP; PROFINET CBA; PROFINET CBA-Proxy; TCP/IP transport protocol; combined MPI/DP connection (MPI or DP master or DP slave); multi-tier configuration up to 32 modules; constant DP bus cycle time; routing; firmware V3.2

## **1.2 PLC Hardware Configuration:**



Slot 1 added power supply module for CPU:

Slot 2 added CPU module:

Which is having the MPI/Profibus and Profinet communication with port-1 & port-2

In the project we used Profibus communication, we assigned Profibus address as 2, so CPU will communicate with WinCC SCADA through this address.

## PLC code development details:

### Step:1

Digital inputs (DI's )

Motor start : M10.0

Motor stop : M10.1

### Step:2

Digital output's (DI's )

Main Contactor ON : M10.2

Star Contactor ON : M10.5

Delta Contactor ON : M10.6

### Step:3

Data variable: Run timer : DB2.DBD22 (32-bit real value)

### Step:4

## 1.3 Creation of data block (DB), function call (FC), and function block (FB):

OB1 - <offline>

```
""
Name: Family:
Author: Version: 0.1
Block version: 2
Time stamp Code: 06/18/2025 09:50:21 AM
Interface: 02/15/1996 04:51:12 PM
Lengths (block/logic/data): 00132 00018 00022
```

Name	Data Type	Address	Comment
TEMP		0.0	
OB1_EV_CLASS	Byte	0.0	Bits 0-3 = 1 (Coming event), Bits 4-7 = 1 (Event class 1)
OB1_SCAN_1	Byte	1.0	1 (Cold restart scan 1 of OB 1), 3 (Scan 2-n of OB 1)
OB1_PRIORITY	Byte	2.0	Priority of OB Execution
OB1_OB_NUMMR	Byte	3.0	1 (Organization block 1, OB1)
OB1_RESERVED_1	Byte	4.0	Reserved for system
OB1_RESERVED_2	Byte	5.0	Reserved for system
OB1_PREV_CYCLE	Int	6.0	Cycle time of previous OB1 scan (milliseconds)
OB1_MIN_CYCLE	Int	8.0	Minimum cycle time of OB1 (milliseconds)
OB1_MAX_CYCLE	Int	10.0	Maximum cycle time of OB1 (milliseconds)
OB1_DATE_TIME	Date_And_Time	12.0	Date and time OB1 started

LAD/STL/FBD - [DB2 -- Test\_Intern\SIMATIC 300(1)\CPU 315-2 PN/DP]

File Edit Insert PLC Debug View Options Window Help

Address	Name	Type	Initial value	Comment
0.0		STRUCT		
+0.0	time_1	INT	0	seconds
+2.0	t1	INT	0	
+4.0	t2_s	INT	0	
+6.0	t3_m	INT	0	
+8.0	t4_h	INT	0	
+10.0	t2_s_d	DINT	L#0	
+14.0	t3_m_d	DINT	L#0	
+18.0	t4_h_d	DINT	L#0	
+22.0	motor_running_hours	REAL	0.000000e+000	
=26.0		END_STRUCT		

## Function Block (FB1):

### FB1 - <offline>

"Motor Control"

Name:

Author:

Family:

Version: 0.1

Block version: 2

Time stamp Code:

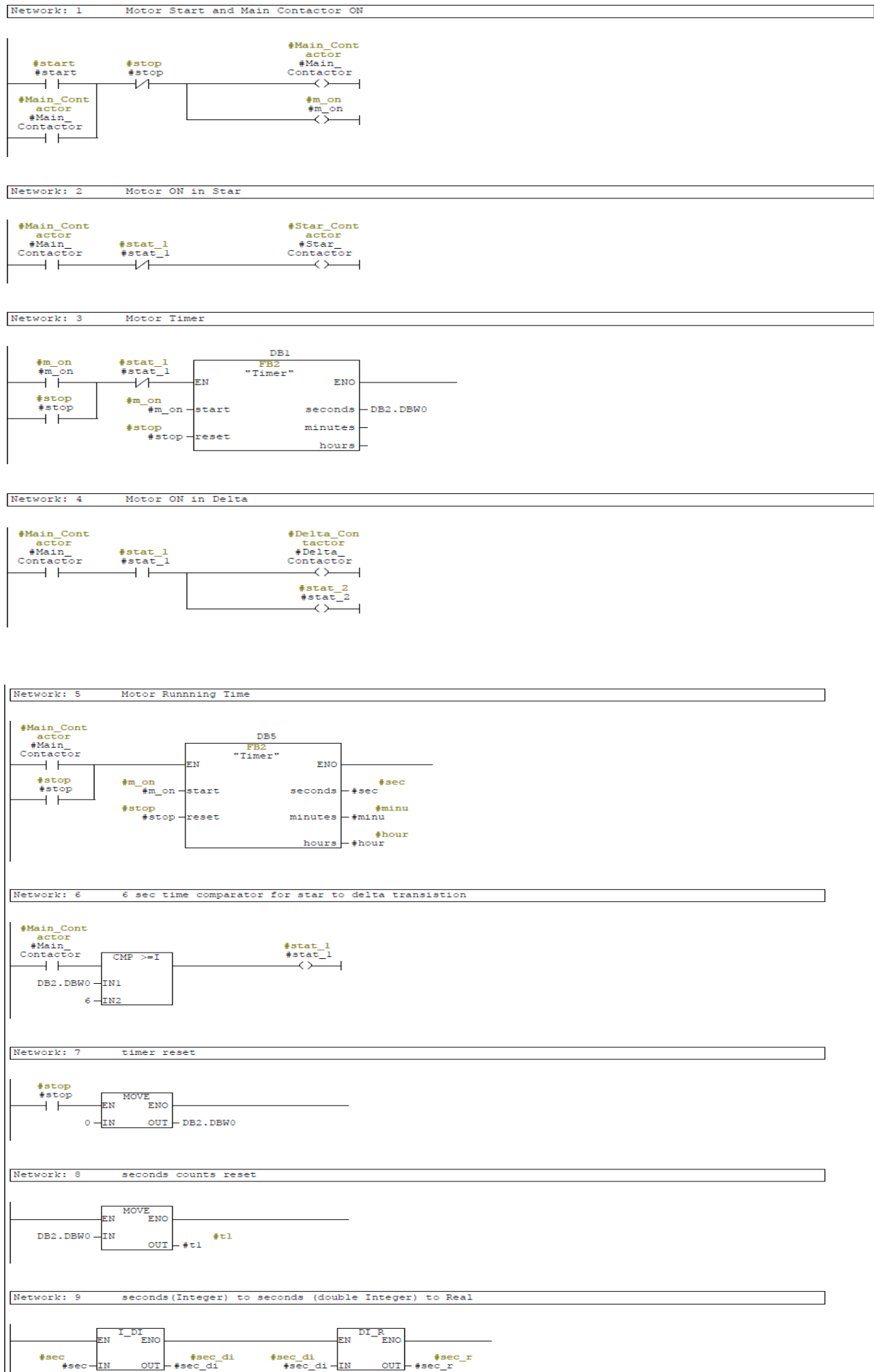
06/18/2025 09:44:28 AM

Interface:

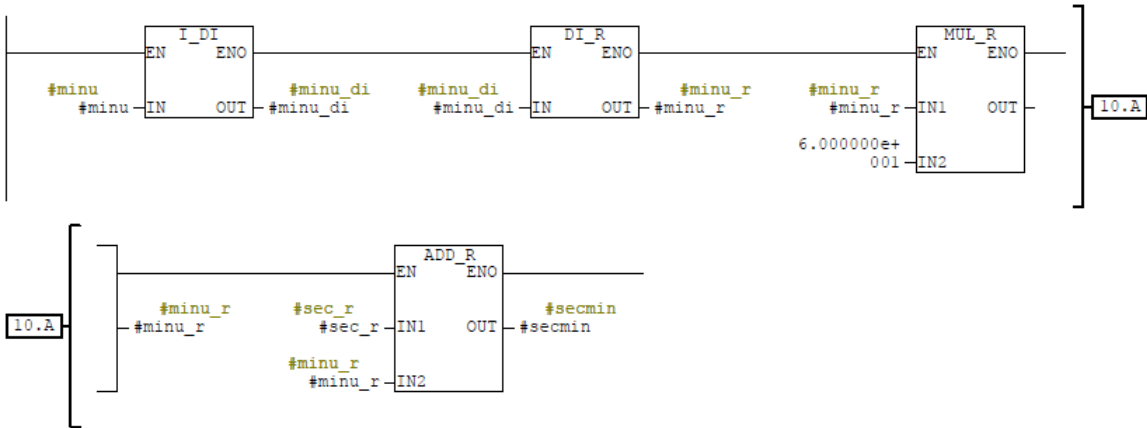
06/12/2025 12:29:01 PM

Lengths (block/logic/data): 00764 00582 00006

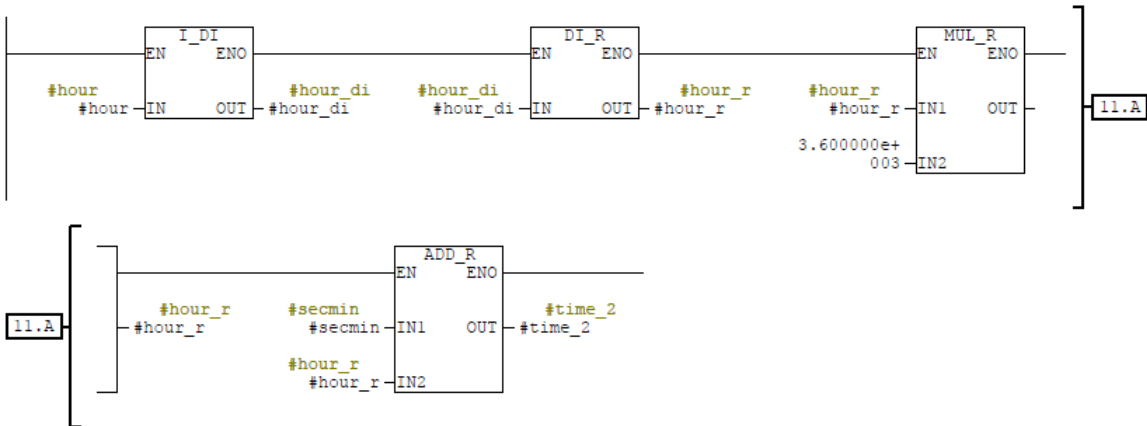
Name	Data Type	Address	Initial Value	Comment
IN		0.0		
start	Bool	0.0	FALSE	
stop	Bool	0.1	FALSE	
OUT		0.0		
Main_Contactor	Bool	2.0	FALSE	
Star_Contactor	Bool	2.1	FALSE	
Delta_Contactor	Bool	2.2	FALSE	
t1	Int	4.0	0	
run_hours	Real	6.0	0.000000e+000	
IN_OUT		0.0		
STAT		0.0		
m_on	Bool	10.0	FALSE	
stat_1	Bool	10.1	FALSE	
p1	Bool	10.2	FALSE	
stat_2	Bool	10.3	FALSE	
sec	Int	12.0	0	
minu	Int	14.0	0	
hour	Int	16.0	0	
sec_di	DInt	18.0	L#0	
minu_di	DInt	22.0	L#0	
hour_di	DInt	26.0	L#0	
sec_r	Real	30.0	0.000000e+000	
minu_r	Real	34.0	0.000000e+000	
hour_r	Real	38.0	0.000000e+000	
secmin	Real	42.0	0.000000e+000	
time_2	Real	46.0	0.000000e+000	
min_mul	Real	50.0	0.000000e+000	
hour_mul	Real	54.0	0.000000e+000	
TEMP		0.0		



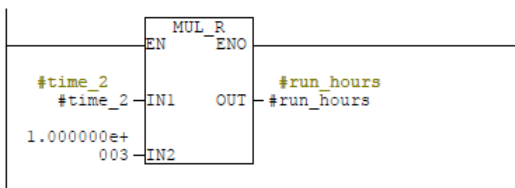
Network: 10 Minutes(Integer) to double Integer to Real



Network: 11 Hours(Integer) to double Integer to Real



Network: 12 time in seconds to milliseconds



## Function Block (FB2):

### FB2 - <offline>

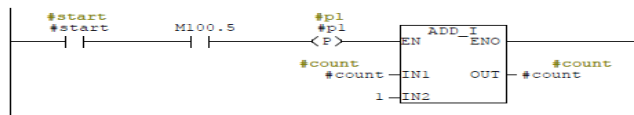
"Timer"  
 Name: Family:  
 Author: Version: 0.1  
 Time stamp Code: 06/18/2025 09:47:19 AM  
 Interface: 06/12/2025 10:51:44 AM  
 Lengths (block/logic/data): 00416 00270 00002

Name	Data Type	Address	Initial Value	Comment
IN		0.0		
start	Bool	0.0	FALSE	
reset	Bool	0.1	FALSE	
OUT		0.0		
seconds	Int	2.0	0	
minutes	Int	4.0	0	
hours	Int	6.0	0	
IN_OUT		0.0		
STAT		0.0		
count	Int	8.0	0	
p1	Bool	10.0	FALSE	
p2	Bool	10.1	FALSE	
minute	Int	12.0	0	
p3	Bool	14.0	FALSE	
hour	Int	16.0	0	
TEMP		0.0		

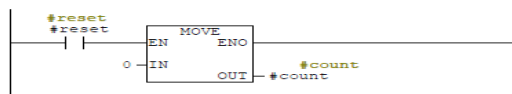
Block: FB2

Timer

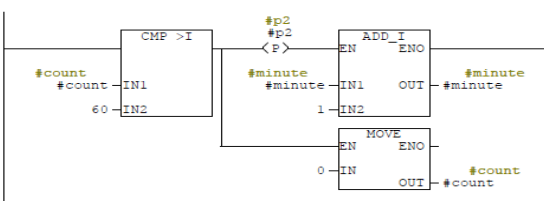
Network: 1 seconds count



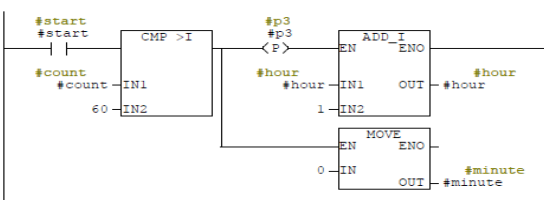
Network: 2 seconds count reset



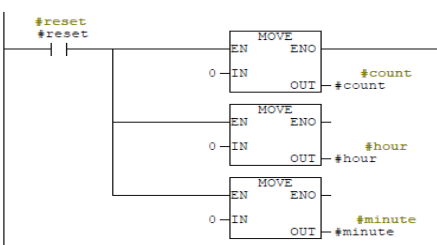
Network: 3 seconds counts reset and minutes count



Network: 4 Minutes counts reset and hours count



Network: 5 reset for timer



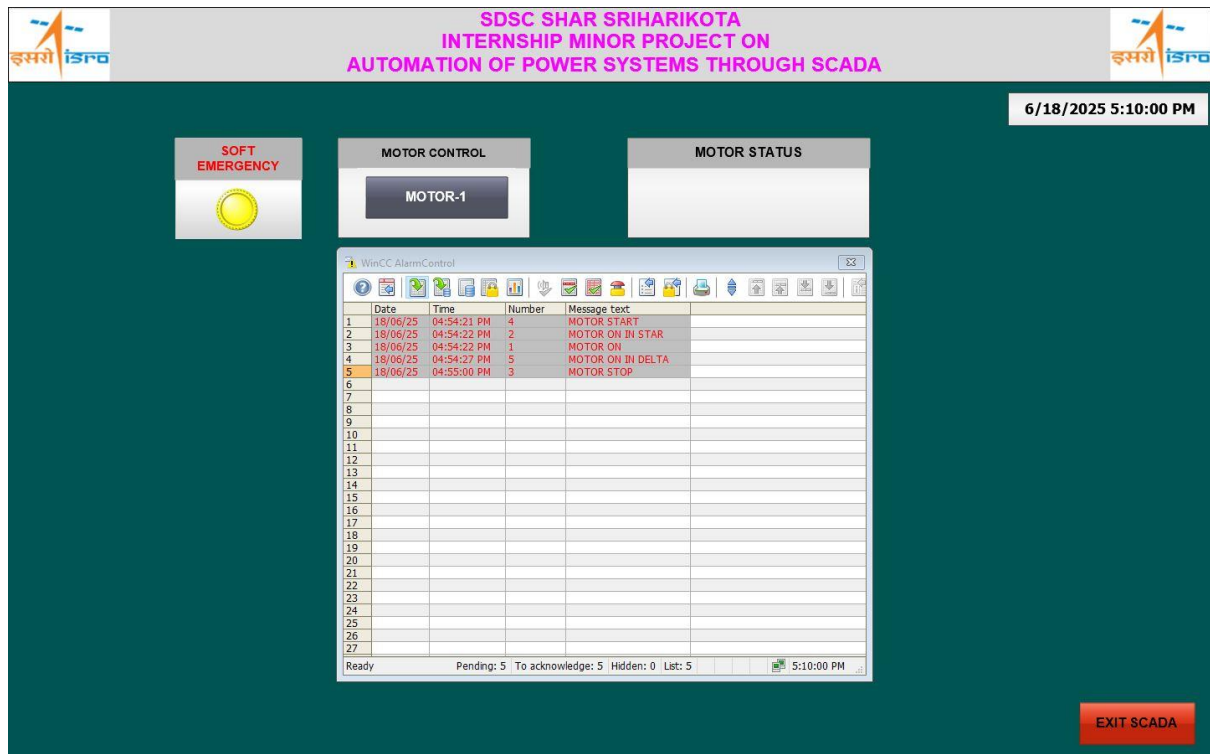
## Step:5

Creation of Tags in the SCADA

## Step:6

Creation of SCADA Mimics

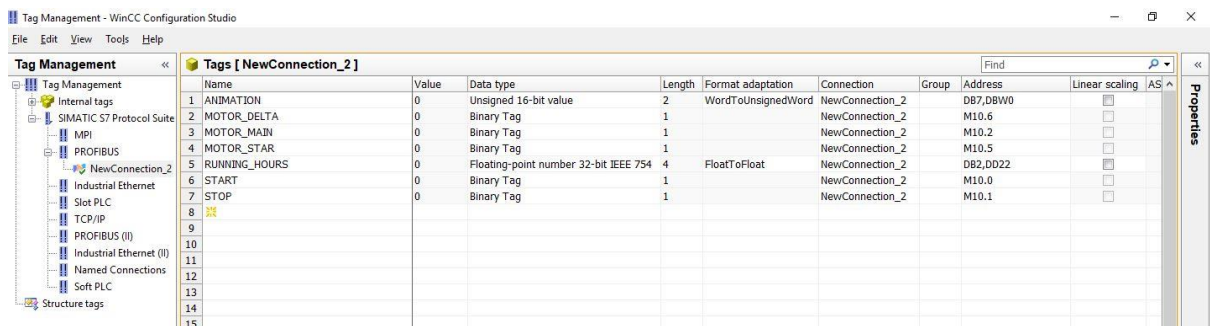
## Main Screen:



The Screens are developed in WinCC Graphics Designer, soft emergency, motor control, motor status, and alarm view mimics are added in the main screen. Individual tag assignments and their properties are added.

For soft button of motor control pop-up activation purpose mouse left click was used, and dynamic assignment of tag was added.

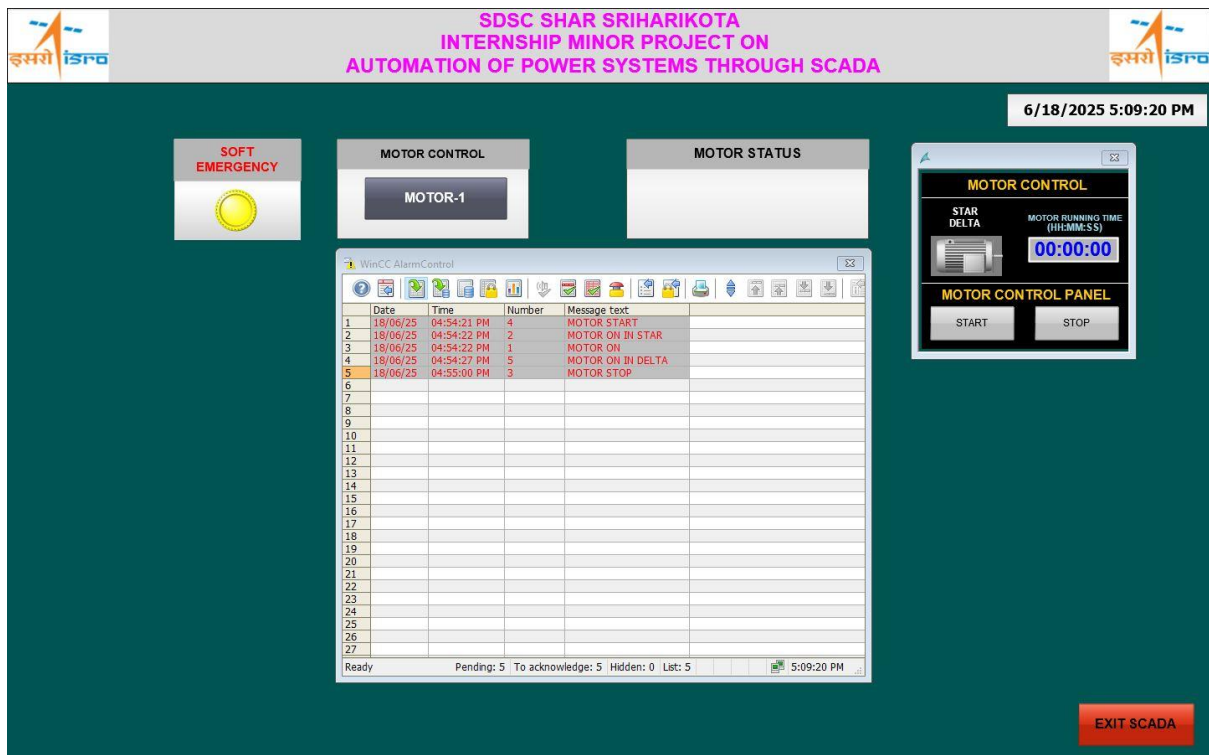
## WinCC Tags:



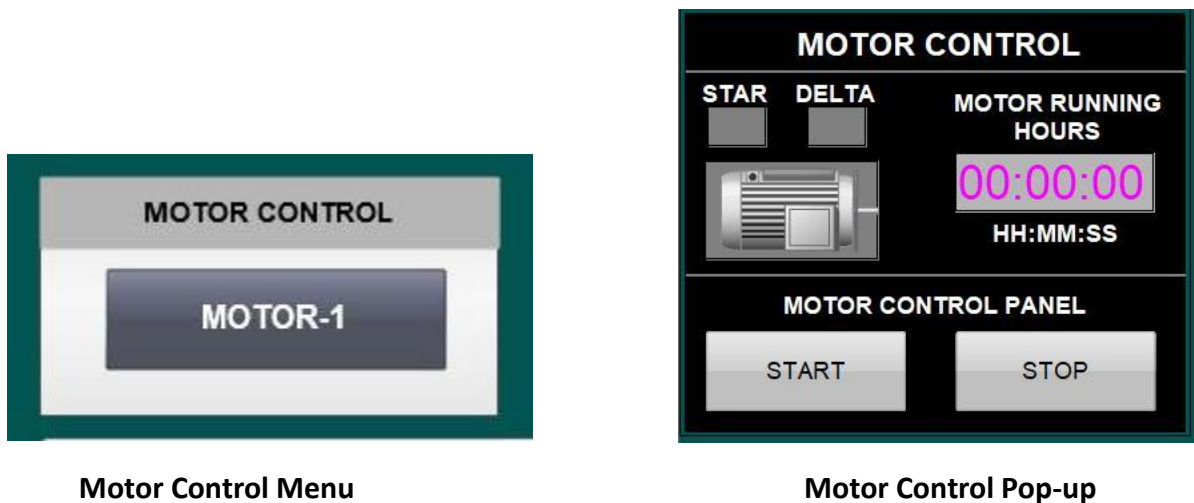
## 1.4 The overview of the main screen:

The main screen contains motor control menu, soft emergency, Exit SCADA and alarm control screens

From the main screen motor control menu, click mouse left key, a pop-up of motor control menu will be appeared, which contains the start, stop, animation of status of motor and motor running time were displayed.



Motor Control menu along with soft button was created for pop-up activation:





Once motor start pressed with mouse left click, then the PLC logic will run for motor. Corresponding animation of motor status also visualised form the pop-up menu. The sequence of operation as follows

At first motor main contactor & motor star contactor will on, after a 6 seconds delay,

Star contactor will de-activated and Delta contactor will on, the main contactor remains on continuously.

Whenever main contactor ON, with this status, a timer also will start run automatically, for motor running time calculation purpose.

The above changed can be observed from SCADA main Screen.

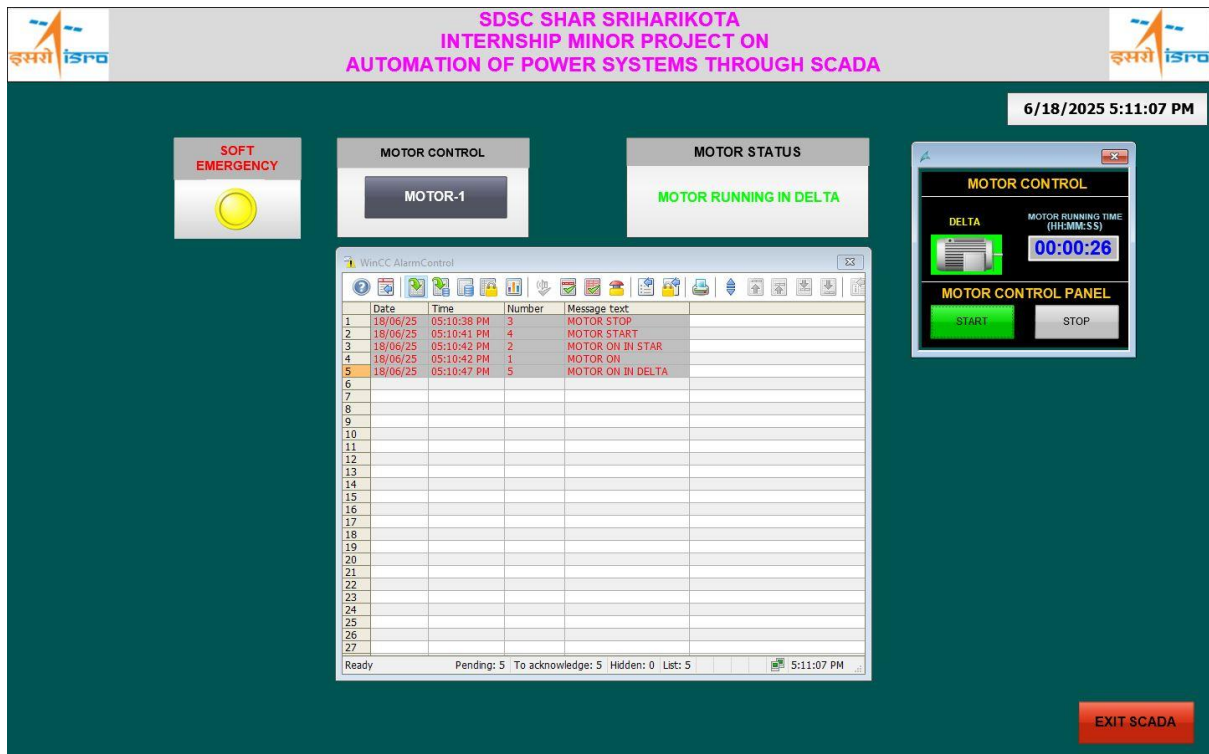
If STOP button from pop-up menu clicked with mouse left key, motor will be stopped and running time also will be reset.

The screenshot displays the SCADA main screen for the project "SDSC SHAR SRIHARIKOTA INTERNSHIP MINOR PROJECT ON AUTOMATION OF POWER SYSTEMS THROUGH SCADA". The interface includes a top header with the project title and logos, a date/time display (6/18/2025 5:10:46 PM), and several functional buttons: "SOFT EMERGENCY" (yellow circle), "MOTOR CONTROL" (MOTOR-1), and "MOTOR STATUS" (MOTOR RUNNING IN STAR). A central "WinCC AlarmControl" window shows a log of events:

Date	Time	Number	Message text
18/06/25	05:10:28 PM	5	MOTOR ON IN DELTA
18/06/25	05:10:38 PM	3	MOTOR STOP
18/06/25	05:10:41 PM	4	MOTOR START
18/06/25	05:10:42 PM	2	MOTOR ON IN STAR
18/06/25	05:10:42 PM	1	MOTOR ON

Below the log, a "MOTOR CONTROL PANEL" pop-up window is visible, showing a "START" button, a "STOP" button, and a "MOTOR RUNNING TIME (HH-MM-SS)" display showing 00:00:05. An "EXIT SCADA" button is located in the bottom right corner.

**Motor running with star**



**Motor running with Delta**

**WinCC AlarmControl**

	Date	Time	Number	Message text
1	18/06/25	05:10:41 PM	4	MOTOR START
2	18/06/25	05:10:42 PM	2	MOTOR ON IN STAR
3	18/06/25	05:10:42 PM	1	MOTOR ON
4	18/06/25	05:10:47 PM	5	MOTOR ON IN DELTA
5	18/06/25	05:12:06 PM	3	MOTOR STOP
6				
7				
8				
9				
10				
11				
12				

**Alarm events also observed through alarm control menu**

If in case, any emergency, we need to protect the system from failure, for that purpose, an emergency soft button also provided in the main menu.

If emergency soft button pressed with mouse left key, then a pop-up message will be appeared in the main screen as “Do you want to activate emergency” yes (or) no

If No pressed, no action,

If Yes pressed, then motor will be stopped.

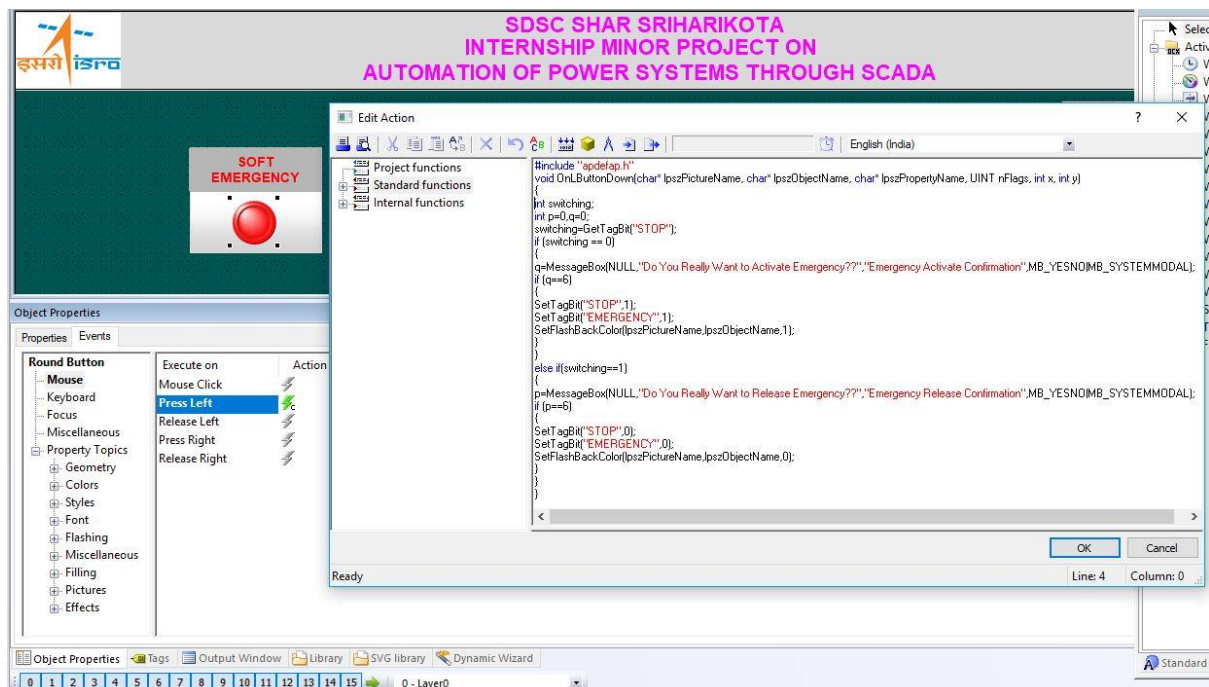
## Emergency Soft Button

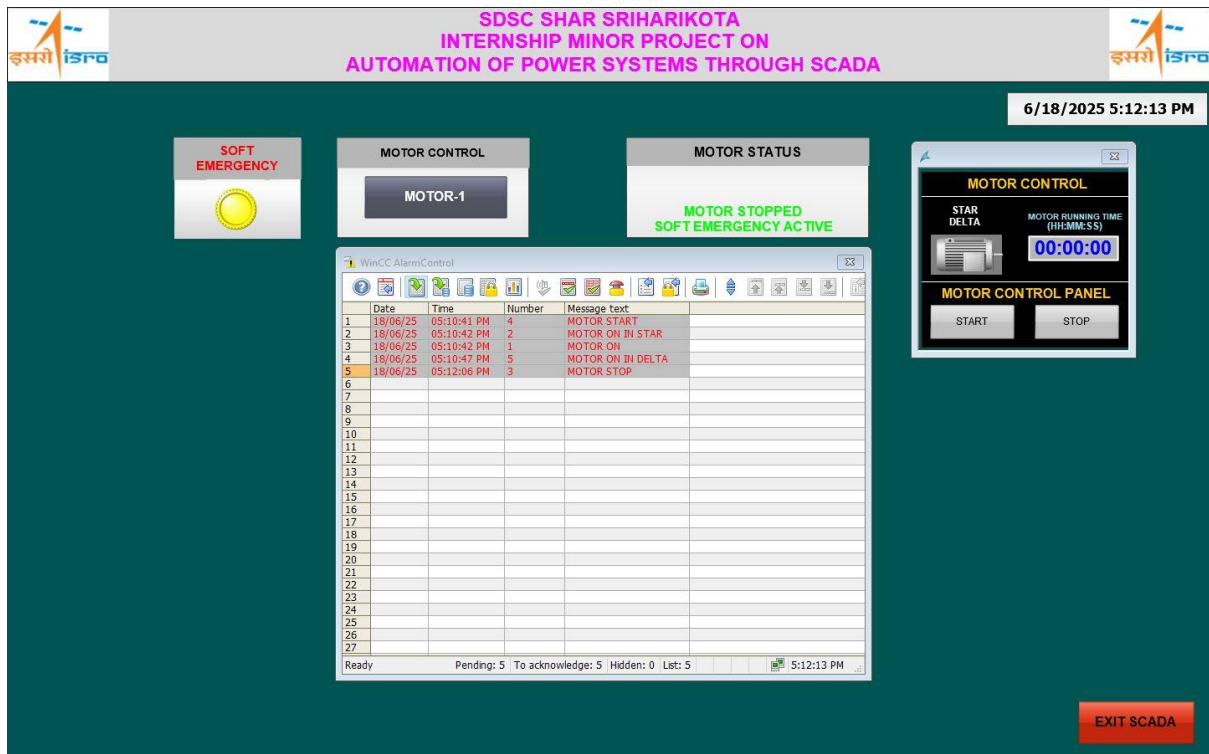


## Pop-Up



The emergency button actions were programmed through C script.





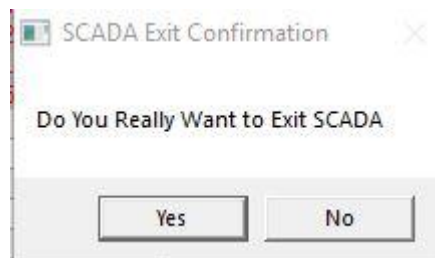
With emergency pressed motor stop can be seen in the main screen

EXIT Soft button also programmed in C script, once this button pressed with mouse left key, SCADA can be exit from run time.

**Exit soft button:**




**pop-up**



**C Script for exit SCADA:**

```
#include "apdefap.h"
void OnLButtonDown(char* lpszPictureName, char* lpszObjectName, char* lpszPropertyName, UINT
nFlags, int x, int y)
{
    int p=0;
    p=MessageBox(NULL,"Do You Really Want to Exit SCADA","SCADA Exit
Confirmation",MB_YESNO|MB_SYSTEMMODAL);
    if (p==6)
    {
        ExitWinCC ();
        //DeactivateRTProject ();
    }
}
```

## 1.5 WinCC Project Documentation

<p><b>WinCC™ Control Center - CS</b></p> <p>Copyright © 1994-2017 by SIEMENS AG</p> <p>\\PULLAIAH_5781\WinCC_Project_Test_Intern\Test_Intern.mcp</p>	
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<b>Computer</b>		
PULLAIAH_5781	Computer Type	Server

<b>Tag Management</b>		
@SCRIPT_COUNT_TAGS	Data Type	32-Bit unsigned
	Group	Script
	Parameters	internal tag
@SCRIPT_COUNT_REQUESTS_IN_QUEUE	Data Type	32-Bit unsigned
	Group	Script
	Parameters	internal tag
@SCRIPT_COUNT_ACTIONS_IN_QUEUE	Data Type	32-Bit unsigned
	Group	Script
	Parameters	internal tag
@TLGRT_SIZEOF_NOTIFY_QUEUE	Data Type	64-Bit IEEE 754
	Group	TagLoggingRt
	Parameters	internal tag
@TLGRT_SIZEOF_NLL_INPUT_QUEUE	Data Type	64-Bit IEEE 754
	Group	TagLoggingRt
	Parameters	internal tag
@TLGRT_TAGS_PER_SECOND	Data Type	64-Bit IEEE 754
	Group	TagLoggingRt
	Parameters	internal tag
@TLGRT_AVERAGE_TAGS_PER_SECOND	Data Type	64-Bit IEEE 754
	Group	TagLoggingRt
	Parameters	internal tag
@CurrentUser	Data Type	Text 8-Bit
	Parameters	internal tag
@DeltaLoaded	Data Type	32-Bit unsigned
	Parameters	internal tag
@LocalMachineName	Data Type	Text 8-Bit
	Parameters	internal tag
@ConnectedRTClients	Data Type	16-Bit unsigned
	Parameters	internal tag
@RedundantServerState	Data Type	16-Bit unsigned
	Parameters	internal tag
@DatasourceNameRT	Data Type	Text 16-Bit
	Parameters	internal tag
@ServerName	Data Type	Text 16-Bit
	Parameters	internal tag
@CurrentUserName	Data Type	Text 16-Bit
	Parameters	internal tag
@ServerVersion	Data Type	Text 16-Bit
	Parameters	internal tag
@PHServer_Principal_State	Data Type	Text 16-Bit
	Group	ProcessHistorian
	Parameters	internal tag
@PHServer_Mirror_State	Data Type	Text 16-Bit
	Group	ProcessHistorian
	Parameters	internal tag
@PHServer_Principal_Details	Data Type	Text 16-Bit
	Group	ProcessHistorian
	Parameters	internal tag
@PHServer_Mirror_Details	Data Type	Text 16-Bit
	Group	ProcessHistorian
	Parameters	internal tag
RUNNING_HOURS	Data Type	32-Bit IEEE 754
	Parameters	DB2,DD22
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite

# WinCC™ Control Center - CS

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\\PULLAIAH\_5781\WinCC\_Project\_Test\_Intern\Test\_Intern.mcp



<b>Tag Management</b>		
	Channel unit	PROFIBUS
START	Data Type	Bit value
	Parameters	M10.0
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
STOP	Data Type	Bit value
	Parameters	M10.1
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
MOTOR_STAR	Data Type	Bit value
	Parameters	M10.5
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
MOTOR_DELTA	Data Type	Bit value
	Parameters	M10.6
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
MOTOR_MAIN	Data Type	Bit value
	Parameters	M10.2
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
ANIMATION	Data Type	16-Bit unsigned
	Parameters	DB7,DW0
	Connection	NewConnection_2
	Channel	SIMATIC S7 Protocol Suite
	Channel unit	PROFIBUS
EMERGENCY	Data Type	Bit value
	Parameters	internal tag

<b>Connections</b>		
NewConnection_2	Unit	PROFIBUS
	Parameters	L2,2 0,,0,0,02

## **Conclusion:**

Based on the knowledge acquired from our study, “Automation of power systems through SCADA” project was carried out by me.

The incorporation of PLC based SCADA system was developed by me and carry out the extensive study about the PLC hardware configuration, PLC code development, testing and simulation was carried out, the same was interfaced with SCADA, and creation of SCADA Configuration, Tag assignments, scripting were done and the project was successfully created and demonstrated.

Motor control in star-delta operation, was programmed in the PLC, and the operator console also developed in the SCADA. The outcome of project was, induction motor operations are done through SCADA locally, and also, can be operated through remotely using winCC web browser.

## **Future scope:**

The created project can be used for not only motors can be used for different type of 2 stage actuators, ON/OFF final control elements, solenoid valves, display of various status in annunciators and also various industrial electrical elements.