Circuit Breaker Using PLC And SCADA

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ABSTRACT: Today, in the era of technology and high-end devices that operate on a live electrical grid, it is considered considerably safer now than in previous years. The rapid and organized growth of the electrical industry has developed effective standards and safety procedures to mitigate different types of major hazards that have resulted in serious injuries and operators' death. Password based circuit breaker control system is a program that accesses only the password specified to trigger the breaker. Here, a provision is also made to change the password. The PLC and SCADA program manages the machine to the full. To enter a password and control relays a matrix keypad is interfaced with the PLC. The entire circuit is built with onboard power supply. The power supply is made of an SMPS. That transforms 230 V AC into 24 V DC and delivers it to PLC. Programming software is used for PLC programming and password configuration.

KEYWORDS: Network service, Trigger, Circuit breaker, Password, PLC, SCADA, Safety, Security.

INTRODUCTION

For purposes of both regular network service and safety of other devices in power systems, circuit breakers play a crucial role in the switching. Usually routine inspection and preventive maintenance are done to ensure circuit breakers are in good condition. Maintenance schedules and procedures usually obey circuit breaker vendors' guidelines although the prescribed schedules may be conservative. Health is the main concern in our everyday lives. All wants to be as careful as possible. The protection mechanism for the electrical line man is designed to monitor a circuit breaker by using an electrical man's security password. Due to a lack of communication and cooperation between the maintenance workers and the electric substation personnel, serious electrical injuries to line people are on the rise during electrical line repair. This proposed program offers a solution that ensures that the maintenance workers, i.e. line guy, are secure.

The line man can only retain the ability to switch on or off the line, as this device has an arrangement that needs a password to run the circuit breaker (on/off). The machine is operated entirely from a PIC microcontroller. For enter the password a matrix keypad is interfaced with the microcontroller. The password entered is compared with that created by the password. If the entered password is right, the line can be switched ON/OFF only then. The line man has to shut off the supply to that line to fix a particular portion of the electric power supply network [1].

The machine then answers him using the LCD display to enter the password. Instead the device produces a password and it will be sent to the phone (whose no is stored in the program). The password-based circuit breaker can also be introduced to provide high security in the automatic door locking system. And it can also be introduced to monitor the power saving electronic appliances.

The device is programmed to monitor a circuit breaker, using an electric line man 's password for protection. Due to lack of communication and coordination between the maintenance worker and the control room, serious electrical injuries to line people are on the rise during electric line repair. This proposed program offers a solution that guarantees protection for maintenance workers or line man. The line man has power over turning circuit breaker ON and OFF using a password. To enter the password a matrix keypad is interfaced with the PLC. The password entered is compared

to that stored in the PLC Controller. System also has control room for introducing new functions, as one PLC and SCADA can be used to gather data from different circuit breaker and transmission line parameters [2].

COMPONENTS

PLC

Programmable Logic Controller is an industrial computer control system that continuously tracks the status of input devices and makes decisions to regulate the status of output devices based on a custom program. Another requirement is a PLC controller with 16 I/O ports and it operates on 24V DC supply [3].

Function of each Pin:

(1) Input terminals
(2) DC output terminals(not used0
(3) Mounting hole
(4) Input LED's
(5) Status LED's
(6) RS-232 Communication Channel
(7) Output LED's
(8) Power Supply line power
(9) Ground screw
(10) Output terminals

The components making PLC work can be broken down into three main areas.

- The power supply and rack
- The central processing unit (CPU)
- The input/output section (I/O module)

PLC 's Brain is the CPU. It consists of a microprocessor, memory chip, and other integrated circuits for logic control, monitoring, and communication control. The CPU has different modes of operation. In programming mode, the logic downloaded from a device is acknowledged. The CPU is then put in run mode, so that the program can be executed and the operation run.

I/O System

The I/O framework provides the physical interface between the device and the PLC. Opening doors on an I/O card shows a terminal strip that links the devices to. Digital or analog devices may consist of inputs. A digital input card handles discrete devices that send a signal, such as push buttons, limit switches, sensors or select switches that is either on or off. Output tools may be of digital or analog types as well. Typical output can range from 0-10 V DC or 4-20 mA.

SMPS

A switched-mode is an electronic circuit that transforms power using high-frequency switching devices and storage elements, such as inductors or condensers, while the switching device is in its non-conductive state. This 230V AC to 24V converter uses 1.5A DC SMPS. The current rate is 35W. It is used to adjust the voltage for DC output from unregulated AC or DC [4].

The SMPS AC to DC Converter has an AC supply. Using a rectifier and filter it is converted to DC by rectification phase. This uncontrolled voltage from the DC is supplied to the filter circuit. This is because the rectifier draws short current pulses around voltage peaks that have substantially

high frequency energy, resulting in reduced power factor. For transform AC into DC, a combination of rectifier and filter is used, and switching is achieved using the power MOSFET amplifier which can achieve very high gain. MOSFET [5] is a low resistance transistor that can withstand high currents. Switching frequency crosses 20 kHz.

Relay

Relay is an electromechanical switch which consists of an electromagnet, an armature, a spring and a collection of electrical contacts. The electromagnetic switch is controlled by a tiny current that energizes the coil and open or close contacts. The relay is similar to the circuit breaker. In practical relay, the circuit breaker must have a signal.
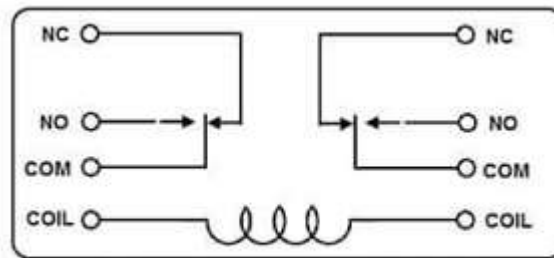

Fig.1: Pin Diagram Of 8 Pin Relay.

Coil: This is the terminal coil. These are the terminals to which you apply voltage to give power to the coils (that will then close the switch). No matter what polarity does. One side is given positive tension, and the other side is given negative tension. No matter every order. Polarity matters only in the case of a diode.

NO: This is normally Open switch. It is the terminal where you connect the unit you want to power the relay when the relay is charged, that is to say when the COIL receives enough voltage. When the relay has no power, the system connected to NO will be off, and will turn on when the relay receives power.

NC: This is the normally closed switch.. This is the terminal where the device you want to power is connected when the relay receives no power. When the relay has no power, the system connected to NC will be on and will turn off when the relay receives power.

COM: If the relay is operated, and the switch is closed, there is continuity between COM and NO. When the relay is not operated and the switch is open, then there is consistency between COM and NC. It is the relay terminal, where the first part of the circuit is connected.

The relay is rated 24 V and therefore needs 24 V to turn ON. It can operate with a slightly lower voltage than 24 V. Even after the positive and negative terminal location is interchanged, it switches on when power is received. The relay's COM terminals get attached to the first portion of the circuit. The relay's NC terminals get power even when the relay isn't working. The relay's NO terminals just get power while running the relay. When relay receives 24 V the relay snaps between open and close [6].

SCADA

A SCADA system is a common industrial process automation system that is used to collect data from remote located instruments and sensors and to transmit data at a central location for either monitoring or to store programs in main memory. The purpose of controlling. The sensor and instrument data collected are normally displayed on one or more SCADA host computers located at the central site. It is possible to transfer automatic or operator-driven supervisory commands to

central, based on the information received from the remote stations. Tools for station control which are also referred to as field devices. The SCADA I/O programming is used to modify the framework for the supervision.

All the more advanced data version of SCADA in the basic SCADA framework has additional secondary memories in the form of magnetic disk modules. SCADA is a common process automation device that collects data from sensors and instruments located to remote sites and transmits data to a controller monitoring process at a central location. Standard and/or custom software collection. Also referred to as Human Machine Interface (HMI) software or Man Machine Interface (MMI) software systems to help the communications network and track and manage remotely placed field data interface devices to SCADA system , the central host and operator terminal program. Network link for the elements in the SCADA architecture serves as a bridge to communication. The inputs of manual data and sensor data are interfaced with the programming tools. Sensor feedback is important for the monitoring of device parameters. The Internet Protocols (IP) are used to communicate between the master station and the equipment. The reality that many SCADA networked systems are accessible from the internet; the systems are potentially vulnerable to remote cyber attack. Security can be improved thanks to the use of standard protocols. However the proposed system uses Local Area Network (LAN) link.
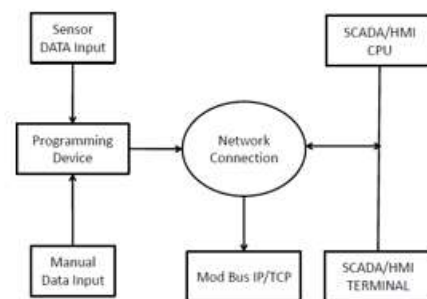

Fig. 2: SCADA Architecture Block Diagram.

Push Button

The push button switch is a push button which normally has opened its default state (NO). It means that when it's pushed down the switch can make electrical contact. The switch is not a latch type of switch indicating that after pressing down, it does not hold its position to close. Single Pole Single Throw (SPST) switch is a simple ON / OFF switch that allows or breaks the two-terminal relation. SPST switch transfers power supply to a circuit. There is no current flow at the circuit while the switch is on or OFF. Such colored red switches are rated at 4A, 24 V AC providing 50,000 cycles of electrical life [7].

Buzzer

A buzzer or beeper is a electronic, electromagnetic or photoelectric (piezo for short) audio signaling device. Typical applications of buzzers and beepers include warning systems, clocks and user input validation, including a mouse click or key stroke. This piezoelectric buzzer has a diameter of 23 mm and has mount holes spaced 30 mm. Supplied with 100 mm lead, it is designed for 3-20 V, and produces up to 30 cm of 85 dB sound. Works at frequencies up to 3.3 KHz. The current requirement lies below 1.5 mA. The natural operating temperature range lies between-C and + C. Japanese manufacturers have developed piezoelectric buzzers, or piezoelectric buzzers, as they are often called. An oscillating electronic circuit or other audio signal source can drive a piezoelectric device, powered by a piezoelectric audio amplifier. Sounds typically used to signal pressing a button are a click or a beep. A piezoelectric buzzer often depends on the vibration of the acoustic cavity or Helmholtz vibration to create an audible beep [8].

WORKING PRINCIPLE

The functioning of this device is quite simple; the operator has to enter correct password in the PLC-connected keypad for PLC-based power. It will give the relay a signal, and therefore the circuit breaker will be tripped. Used in device for indicating the above process indicator light. Lamp is gone. The circuit breaker is tripped when another password is inserted into the keyypad, it does not lock. SCADA based service is available for remote control. Sign in to the network and then run the circuit breaker needs a user ID and password. SCADA-based control is not possible when the circuit breaker is tripped by PLC, as this means that the line is under repair and only one with the PLC-based control password can close the circuit breaker. The SCADA-based regulation is used when there is no on-line maintenance work. The password is provided to the maintaining lineman. To higher authorities the user ID and password to logging into the SCADA device is. You should change your password regularly to add extra protection.

A three phase line is run in the project using one password to switch the circuit breakers of all three phases ON and OFF. For each step three relays are identical to the three circuit breakers. They use three indicator lamps to indicate the output. The password has to be entered in the appropriate sequence otherwise on the alarm the PLC would activate. If the alarm is triggered, the operator must reset the device and re-enter the password as stored in the PLC database in the appropriate sequence.

Ladder Logic: Ladder logic is a programming language that generates and describes a system based on circuit diagrams, via ladder diagrams. This is used mainly for designing PLC programs or applications. The full system of ladders looks like a ladder but it is an electrical circuit. The left and right rails show that a power supply is positive and grounded. The rungs reflect the wiring between the various components all of which are in the CPU's virtual world in the case of PLC. The software screenshots shown below represent the ladder logic for the proposed system.

Algorithm:

Step 1: Start.

Step 2: Initialize the system.

Step 3: Read the input or password from keypad.

Step 4: If password is correct then Breaker is ON/OFF.

Step 5: If the password is wrong then go to step no.3.

Step 6: Stop.

Application

1. Used in electrical substations and switchyards in the vicinity of power plants where high voltage circuit breakers are located to ensure safety at line man.

2. Keep track of on / off circuit breaker after commissioning for routine breaker maintenance to ensure long service life.

3. It can be used as an electrical machine control based on Password, or as a load control and monitoring system.

Advantages

1. protects the line man from electrical injuries.

2. Monitoring and monitoring of circuit breakers in real time is possible.

3. No analog counter requirement to record circuit breaker on / off after commissioning.

4. System is quick and easy to build and implement because it includes components widely available.

5. Provides scope for further progress.

CONCLUSION

In the era of technology and high-end devices that operate on a live electrical grid, it is considered considerably safer now than in previous years. The electrical industry 's rapid and structured growth has developed effective standards and established safety procedures to minimize various types of major hazards that resulted in severe operator injuries and deaths. However, if the line situation needs to fix this is where the work is going to be. This paper developed a password based circuit breaker control system to ensure the PLC & SCADA protection of the electrical line man. This proposed system provides circuit breaker system automation and real-time supervisory control.

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