Exp 4: Study of Electrical Wiring and Protective Fuses.

Aim: Study of Electrical Wiring and Protective Fuses.

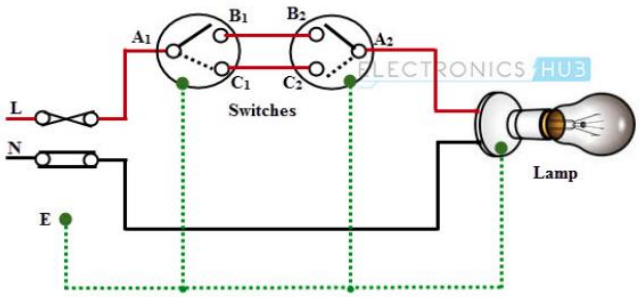
Theory:

Staircase wiring circuit diagram & working

Staircase wiring is a common multi-way switching or two-way light switching connection. Here one lamp is controlled by two switches from two different positions. That is to operate the load from separate positions such as above or below the staircase, from inside or outside of a room, or as a two-way bed switch, etc.

A Staircase wiring makes the feasibility for the user to turn ON and OFF the load from two switches placed apart from each other.

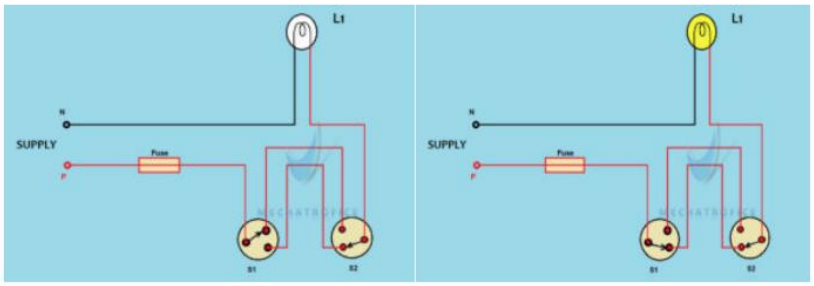
Staircase wiring circuit arrangement



The First pole and second pole of the SPDT switch S1 has connected to the corresponding first and second pole of the SPDT switch S2. That is similar poles of both two switches are connected each other.

The phase of the supply line is connected to the common pole of a switch. And the phase line to the load is taken from the common pole of the next switch. It makes an arrangement that, to close the circuit both the switches should be in the same position in order to make the two common poles in contact to achieve a closed circuit. Changing ON & OFF condition of a single switch can determine whether the circuit is closed or open.

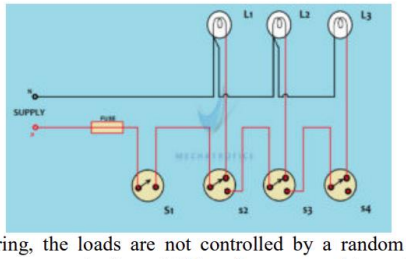
Thus in staircase wiring, we can control the load from both positions. If a truth table has made for the above system output, it will have a result similar to an XNOR gate. That is the light ON's when both the switches are in the same position.



Switch 1 Position	Switch 2 Position	Lamp Position
UP	UP	ON
UP	Down	OFF
Down	UP	OFF
Down	Down	ON

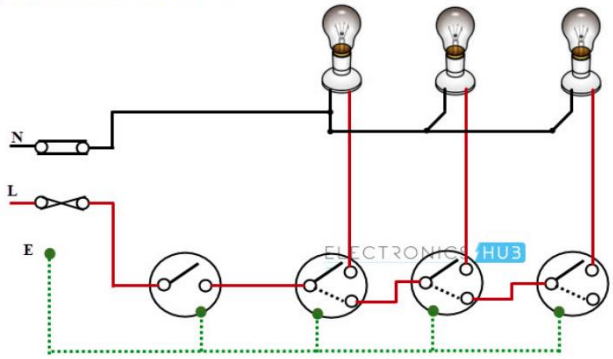
Godown wiring circuit diagram and working

Godown wiring uses to operate lamps/loads in a sequential manner, where only one load operates at a time. As its name implies " Godown wiring ", it is commonly used for light switching in godowns, tunnel-like structures, long passages.. etc, where the light is only required for passage or it requires only at one position at a time. The advantage of the godown wiring is the previous load will be turned off when we normally switch ON the next load.



In godown wiring, the loads are not controlled by a random switching. The user should follow a linear sequence in the switching, from one end to another. That is, to close the circuit for a final load the remaining switches should be ON. That is the load is in series with remaining switches from the beginning end. So the circuit opens if any of the previous switches have flipped OFF.

Godown wiring circuit arrangement



The phase has connected to the common pole of the first switch. The 1st throw of the switch has connected to load. And the 2nd throw has connected to the common pole of the next switch. Initially, common poles of all the switches are positioned to the 1st throw of the SPDT switch. So in such an arrangement, changing the switch position to 2nd throw OFF's previous load and ON the next one. By this arrangement, an infinite number of loads can be connected in a sequence. Switch S1 in the circuit is SPST and remaining are SPDT also called as a changeover switch.

Fuse:

A fuse is a short piece of metal, inserted in the circuit, which melts when excessive current flows through it and thus breaks the circuit. It is always connected in series.

Characteristics of Fuse Element: The function of a fuse is to carry the normal current without overheating but when the current exceeds its normal value; it rapidly heats up to melting point and disconnects the circuit protected by it. In order that it may perform this function satisfactorily, the fuse element should have the following desirable characteristics:

- Low melting point e.g., tin, lead.
- High conductivity e.g., silver, copper.
- free from deterioration due to oxidation e.g., silver
- Low cost e.g., lead, tin, copper

The most commonly used materials for fuse element are lead, tin, copper, zinc and silver.

Advantages

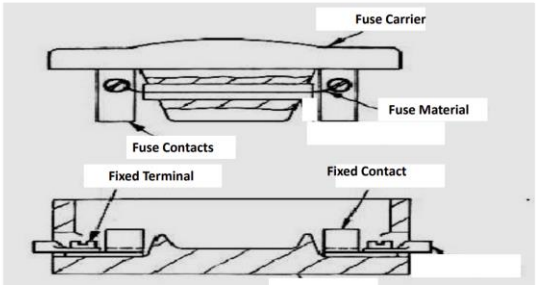
- ✓ It is the cheapest form of protection available.
- ✓ It requires no maintenance.
- ✓ Its operation is inherently completely automatic unlike a circuit breaker which requires an elaborate equipment for automatic action.
- ✓ It can break heavy short-circuit currents without noise or smoke.
- ✓ The smaller sizes of fuse element impose a current limiting effect under short-circuit conditions.
- ✓ The inverse time-current characteristic of a Fuses Definition makes it suitable for over current protection.
- ✓ The minimum time of operation can be made much shorter than with the circuit breakers.

Disadvantages

- ✓ Considerable time is lost in rewiring or replacing a fuse after operation.
- ✓ On heavy short-circuits, discrimination between fuses in series cannot be obtained unless there is sufficient difference in the sizes of the Fuses Definition concerned.
- ✓ The current-time characteristic of a fuse cannot always be co-related with that of the protected apparatus.

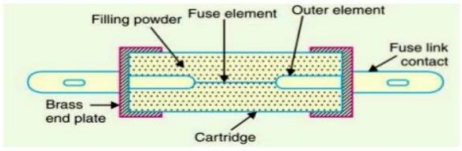
Types of Fuses:

Rewirable Fuse



Cartridge or H.R.C. Fuse

High Rupturing Capacity (HRC) Fuse



Conclusion: