# Basic Motor Control

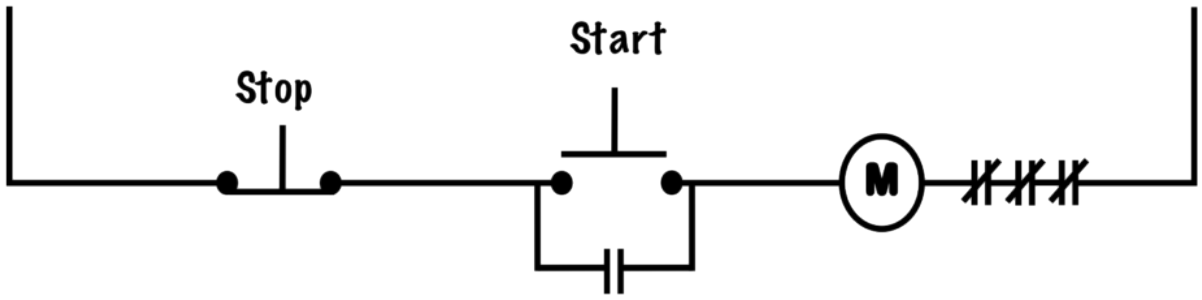
# 31.

# Manual Circuits

A manual circuit is one that is stopped and started by a person. These circuits might have automatic features (such as overload protection) but their main feature is that they require some sort of input from a human operator.

The most fundamental manual circuit is the stop-start **three-wire circuit**. A firm understanding of this circuit is necessary because many of the features of the three-wire circuit scale upwards to more complex circuits.

## Basic Three-Wire Circuit




*A basic three-wire schematic drawing*

The components in the circuit above consist of a **normally closed**, momentary-contact stop **pushbutton**; a **normally open**, momentary-contact start pushbutton; and a **motor starter**. These components may be housed in the same compartment, or the pushbuttons could be installed separately from the motor starter. The motor starter itself is connected in **series** with the three normally closed **overload relay** contacts.

The unique component of the circuit, indeed the device that allows the circuit to provide **low-voltage protection (LVP)**, is the normally open instantaneous contact connected in **parallel** with the start button. The normally closed stop button offers no opposition to the flow of current.

When power is on and the motor is not running, current can pass neither the normally open start button, nor the normally open contact, and so the motor does not start.

When an operator comes and pushes the start button, current is able to pass through the **contacts** as the button is depressed. This completes the circuit and energizes the coil of the motor starter, pulling in the **armature**. The three **horsepower-rated contacts** will close, as well as the normally open **auxiliary contact** in parallel with the start button.

The normally closed contacts in series with the coil are controlled by the thermal action of the overload relays, and not the movement of the armature, so they remain closed as long as an **overload** does not occur.

Once the normally open contact (called a holding, maintaining or 2 – 3 contact) is closed, the operator is now free to release the start button. The current will continue to have a path through the circuit, keeping the starter coil energized. In reality this all happens in a fraction of a second, and so the holding contact will be closed before the operator's finger has come off the start button.

Now the motor will continue to run until current to the motor starter is interrupted. This could happen if the operator presses the normally closed stop button or if an overload occurs and one of the normally closed OLR contacts opens up. If a power outage occurs during normal operation, the starter coil will drop out and the motor will stop as well.

In any situation where the motor starter becomes de-energized and the armature is pushed open by the spring inside it, all contacts associated with the coil return to their normal condition. The motor will not restart without further input from an operator as the holding contact will have returned to its normally open state.

With the installation of an auxiliary contact in parallel with the momentary start button, any circuit can provide low-voltage protection (LVP).

Start/Stop Pushbutton
circuit
(Basic 3 wire)

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