

Introduction:

This experiment will introduce the concept and operation of a reduced-voltage motor starter and then will add the ability for directional control (forward-reverse) into the motor controller.

WARNING – Switch OFF the power supply before constructing and/or modifying any circuit or if the system appears to be operating in an uncontrolled/unsafe manner.

Procedure:

1. If not already present, construct the following manually-controlled, series-resistance motor-starter: (Do **NOT** energize the system until instructed)

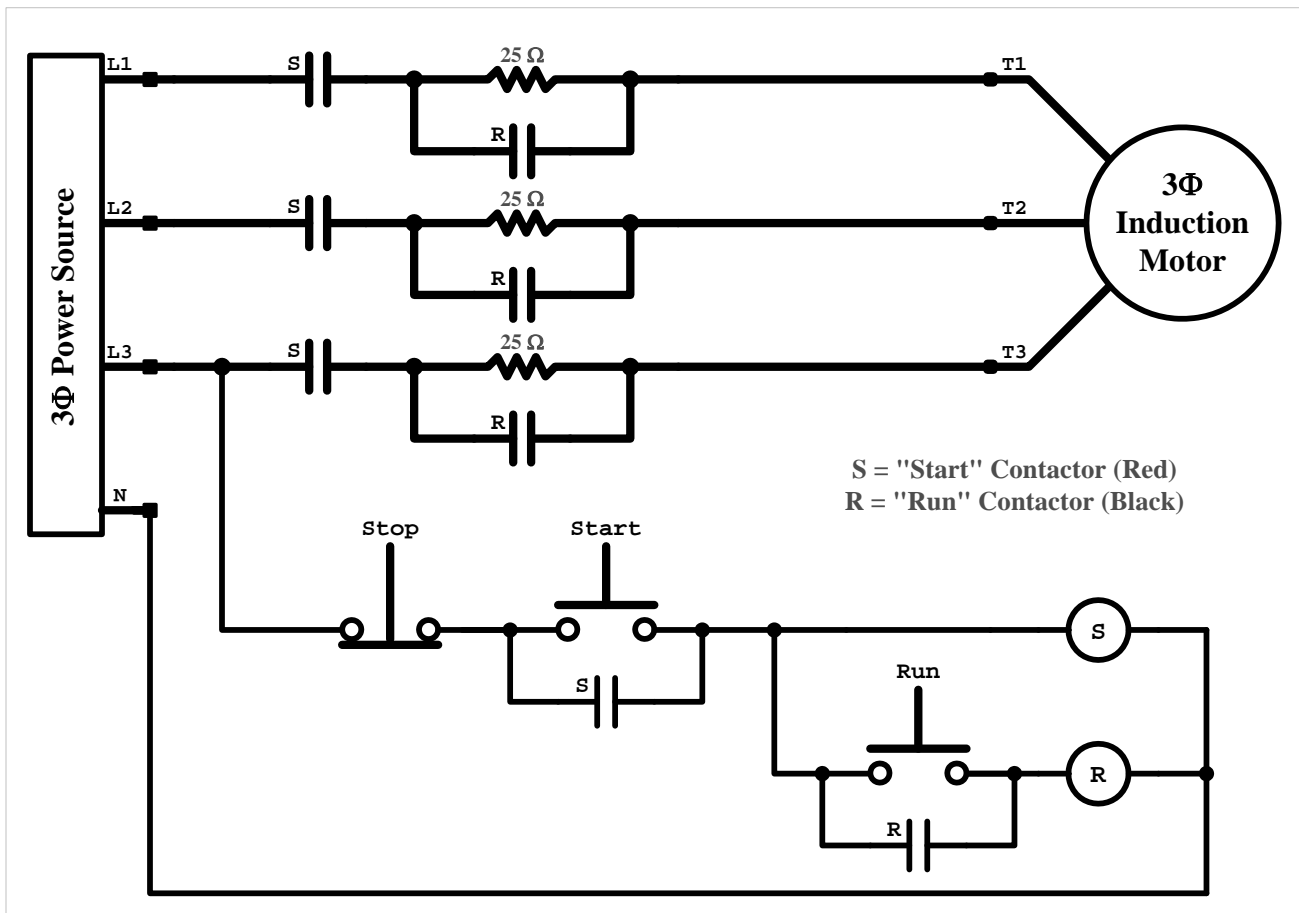


Figure 4.1 – Schematic Diagram of a Series-Resistance Motor-Starter

The resistance value shown, 25Ω, is the value that should limit the starting current of the LabVolt, ¼-hp, 208V, Squirrel-Cage, Induction Motor to roughly 200% of its rated current. (The theory/calculations used to determine the resistance value are shown in the associated PowerPoint presentation.)

The starter is designed such that the operator must first press the “Start” button to energize the motor through the series resistors and then press the “Run” button in order to bypass the resistors once the motor has sufficiently accelerated.

Note that, due to the limited availability of equipment in the lab, a similar circuit may also be constructed using a set of series-connected inductors having the same impedance magnitude.

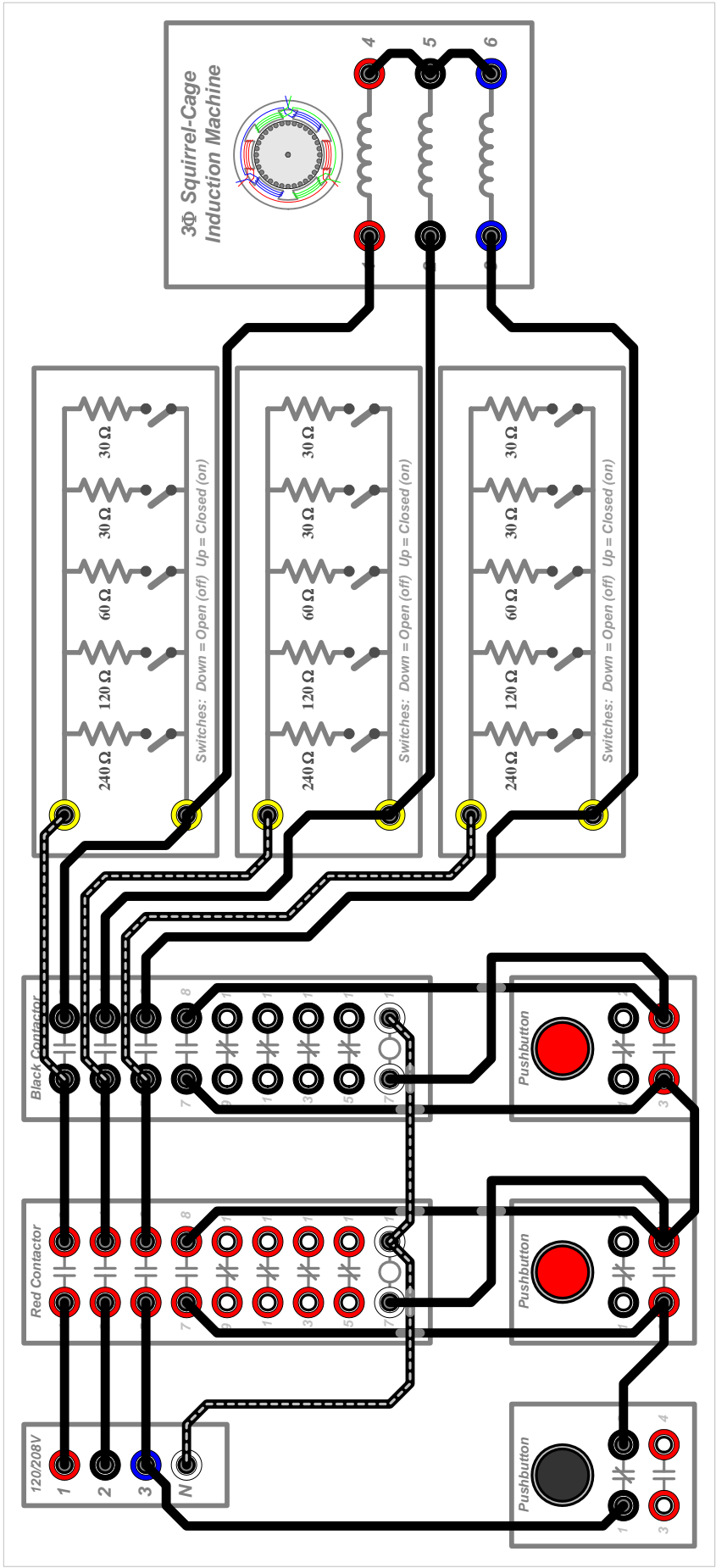


Figure 4.2 – Wiring Diagram for the Series-Resistance Motor-Starter

- Verify the proper operation of the series-resistance motor-starter. Utilizing a pair of digital multimeters, determine the motor's starting line-voltage and line-current.

Note that you may want to utilize a dynamometer to add a load-torque onto the shaft of the Induction Motor in order to decrease the rate at which the motor is able to accelerate at startup.

Be prepared to discuss the operation of the motor-starter.

(Do NOT proceed to the next step until instructed)

- If a separate, pre-wired, time-delayed, series-resistance motor-starter is not already available, re-wire the previously constructed control circuit to include a time-delay relay as shown below:

(Do NOT make changes to the power portion of the series-resistance starter)

(Do NOT energize the system until instructed)

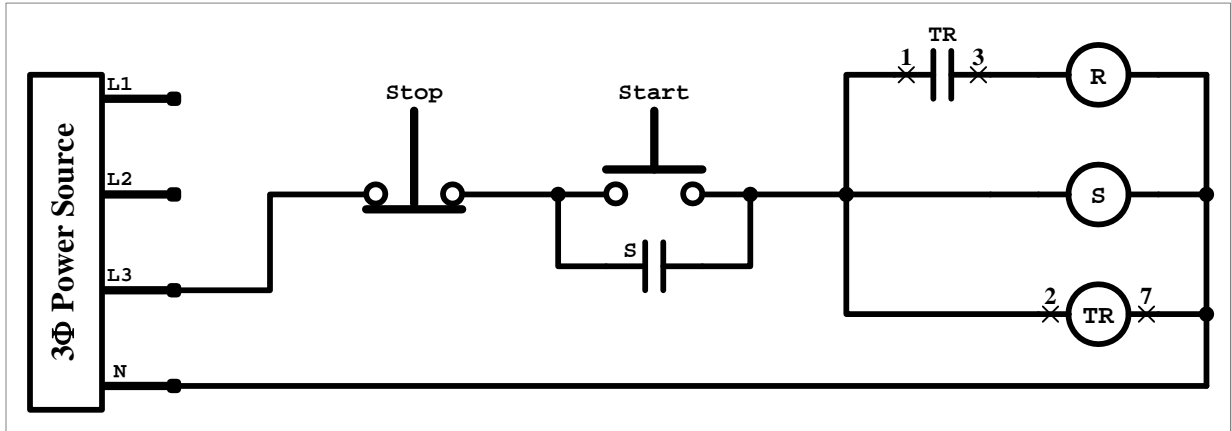


Figure 4.3 – Schematic Diagram of the Time-Delayed, Series-Resistance Control Circuit

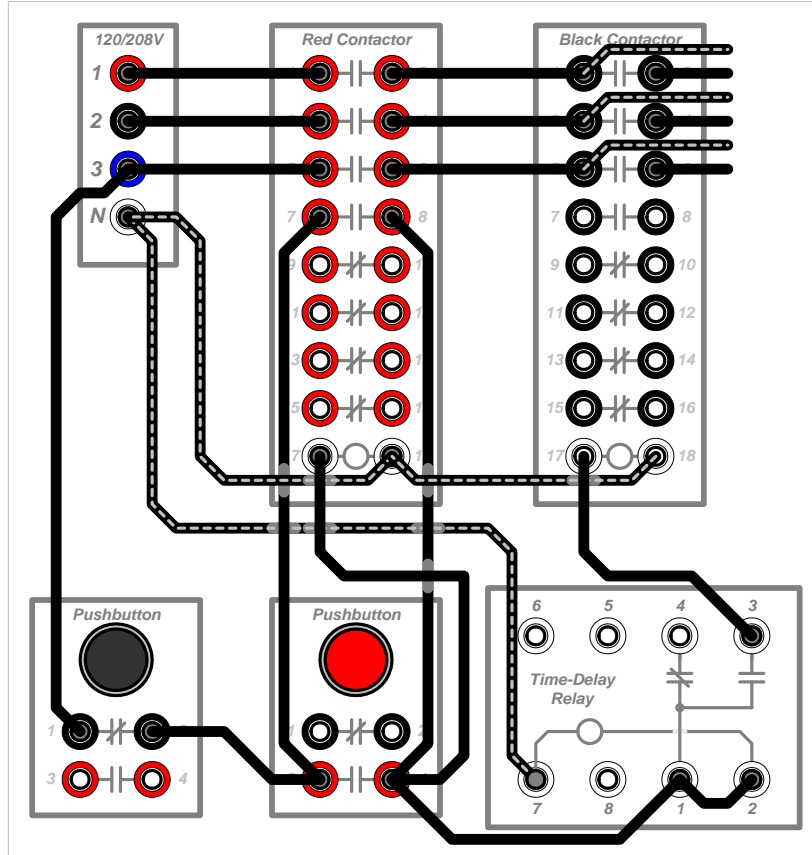


Figure 4.4 – Wiring Diagram for the Time-Delayed, Series-Resistance Control Circuit

- Adjust the time-delay relay such that it has a time delay of roughly 2 seconds and verify the proper operation of the time-delayed, series-resistance motor-starter.

You may want to utilize a dynamometer to add a load-torque onto the shaft of the Induction Motor in order to decrease the rate at which the motor is able to accelerate during startup.

Be prepared to discuss the operation of the time-delayed, series-resistance motor-starter.

- If a separate, pre-wired, time-delayed, series-resistance motor-starter with directional control is not already available, modify the power portion of the time-delayed, series-resistance starter to include the new contacts shown in black in the following figure:

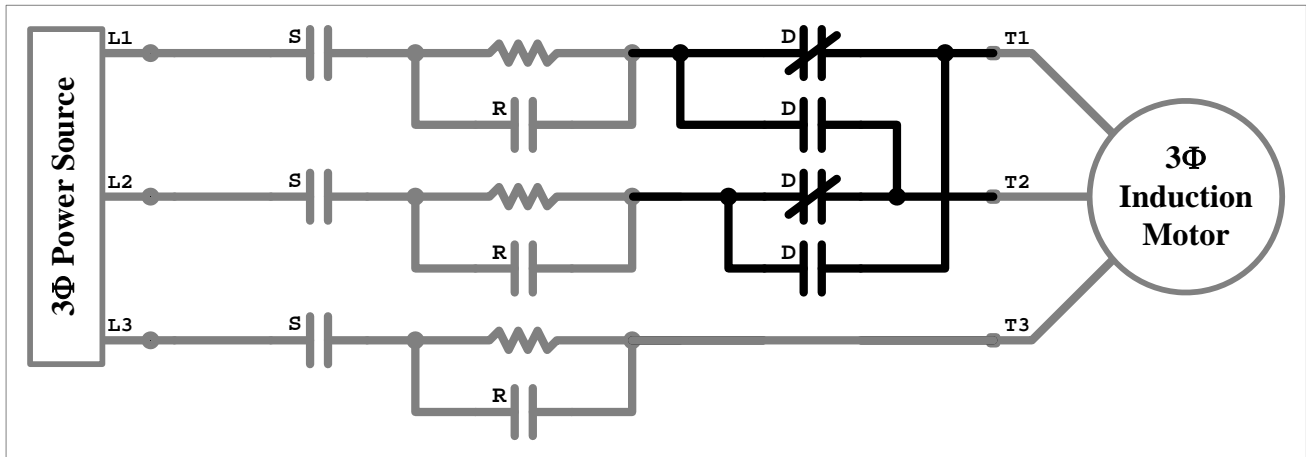


Figure 4.5 – Schematic Diagram for the Addition of Directional Control into the Power Circuit

(Have your instructor check the wiring before proceeding to the next step)

- Similarly, if a separate, pre-wired, time-delayed, series-resistance motor-starter with directional control is not already available, **add** the following components to the control circuit:

(Do NOT change or modify the existing control circuit)

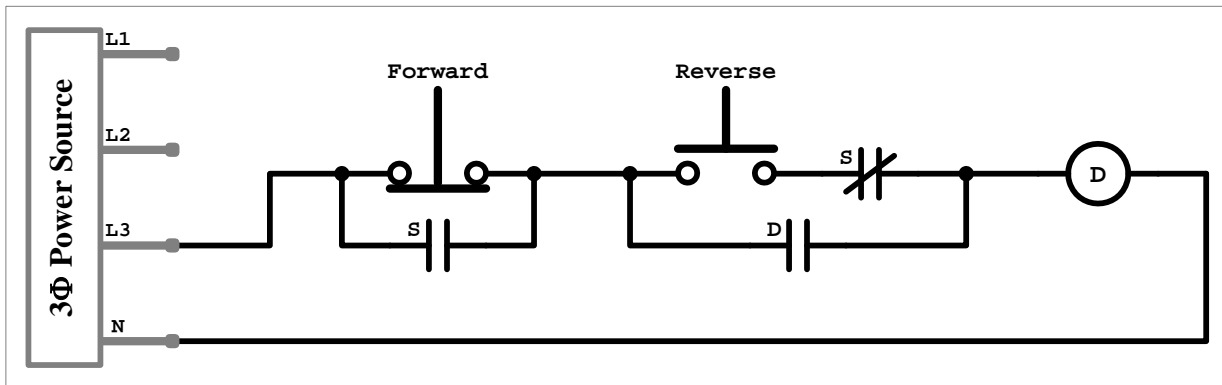


Figure 4.6 – Schematic Diagram for the Addition of Directional Control into the Control Circuit

(Have your instructor check the wiring before proceeding to the next step)

- Verify the proper operation of the directional control aspect of the modified circuit. Check to see whether or not the operator can change direction once the motor is already energized.

Be prepared to discuss the operation of the time-delayed, series-resistance motor-starter