ENEL 417
CAPSTONE PROJECT

Home Energy Management System (HEMS)

COMMISIONING PLAN

DEVICE ENERGY MONITOR

POWER SUPPLY AND SWITCHING UNIT

WRITTEN BY:

Bikramjit Singh Saini

Objective: Commissioning of the Power Supply, Optocoupler Triac and Relay Circuit.

Specifications: Below are the specifications of the system under test

1. **Operating Voltage**: 120 VAC
2. Power Supply must supply 3.3 VDC (+/- 120 mV) and 600 mA (+/- 100 mA) of current at the output*
3. The DC Relay have a coil voltage of 3.3 VDC (~ 50mA)
4. The contact of the DC relay must be rated at 120 VAC and 40 mA current in order to operate the AC relay with coil voltage120 VAC (4VA: 33.33 mA)
5. **Load Switching capability:** Typical 25 A. Maximum 30 A. (at 120 VAC)

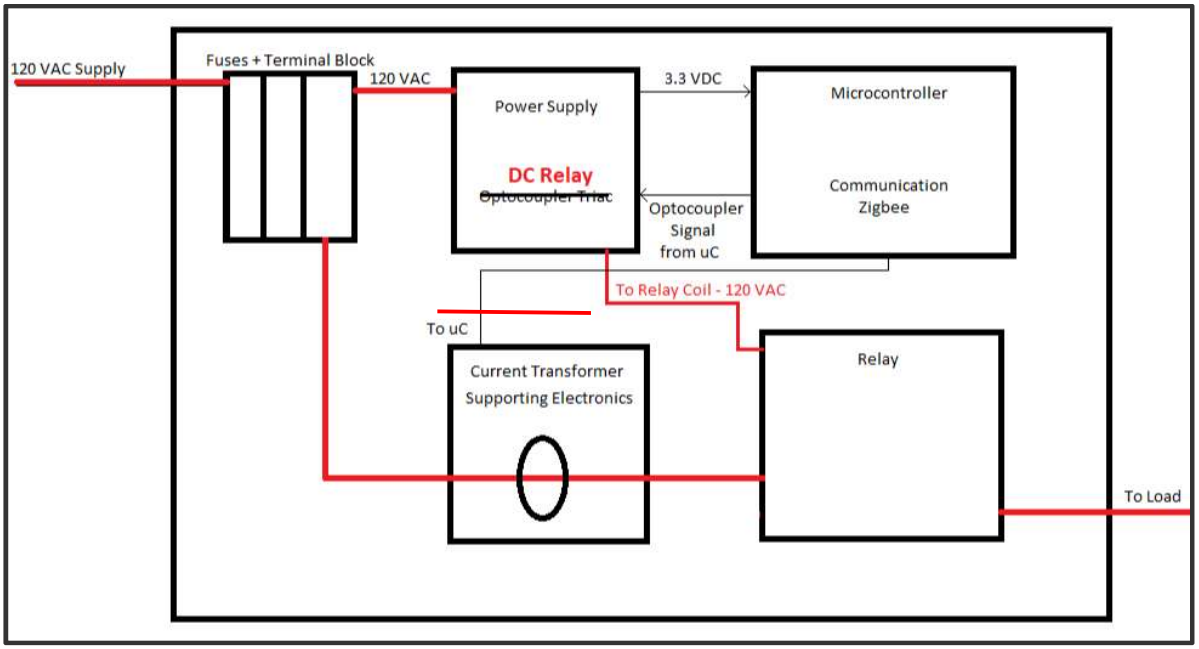


Figure 1.0: Device Energy Manager (Power Supply and Optocoupler Triac: System Under Test)

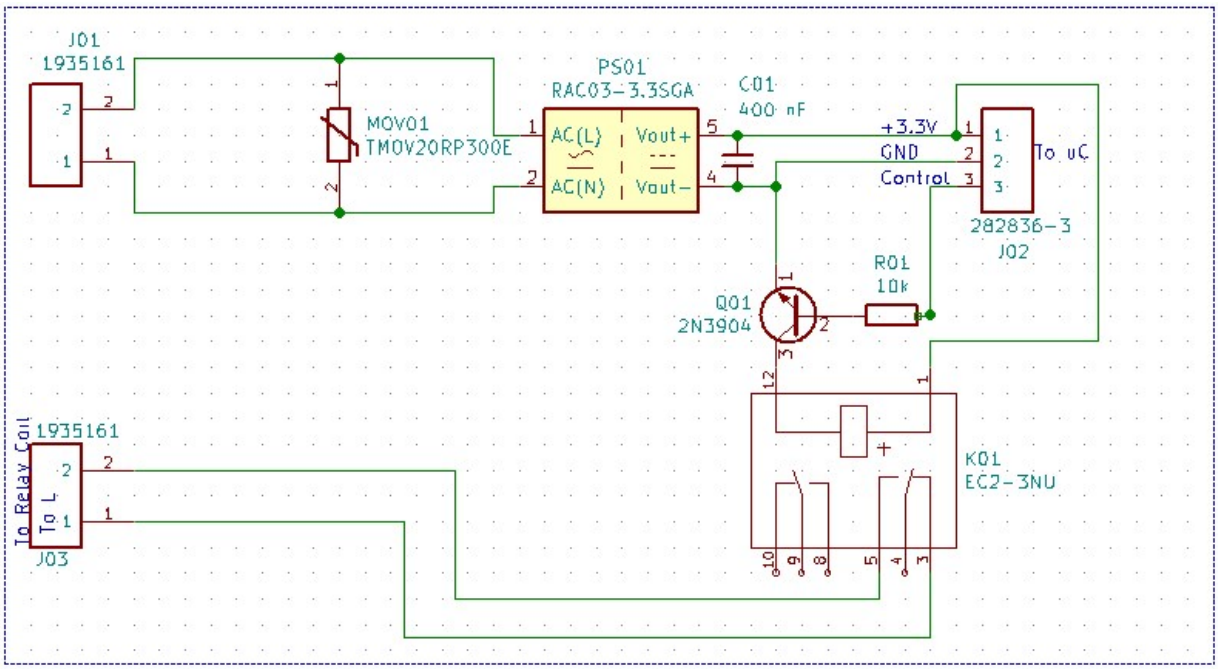


Figure 1.1: Power Supply and Switching Circuit Schematic

Safety Checklist: This checklist must be completed and checked by your supervisor before starting the commissioning process described below as the circuit involves working with 120 VAC:

Safety Checklist for Testing Circuits Involving 120 VAC Date: yyyy/mm/dd		
S. No	**Task**	**Completed (Y/N)**
1	Use the isolation transformer and variac for testing circuit as shown in figure 1.3 below	**Y**
2	Use the 120 VAC supply from the same circuit (figure 1.3) to power the AC switching circuit	**Y**
3	Do not connect AC power/load to the load contacts of the relay	**Y**
4	**Supervisor:** The procedure mentioned in step 1 and 2 is followed	**Name: Doug Wagner** **Signature:**
5	**Supervisor:** The wiring is verified and the circuit is ready to be energized and tested	**Name: Doug Wagner** **Signature:**

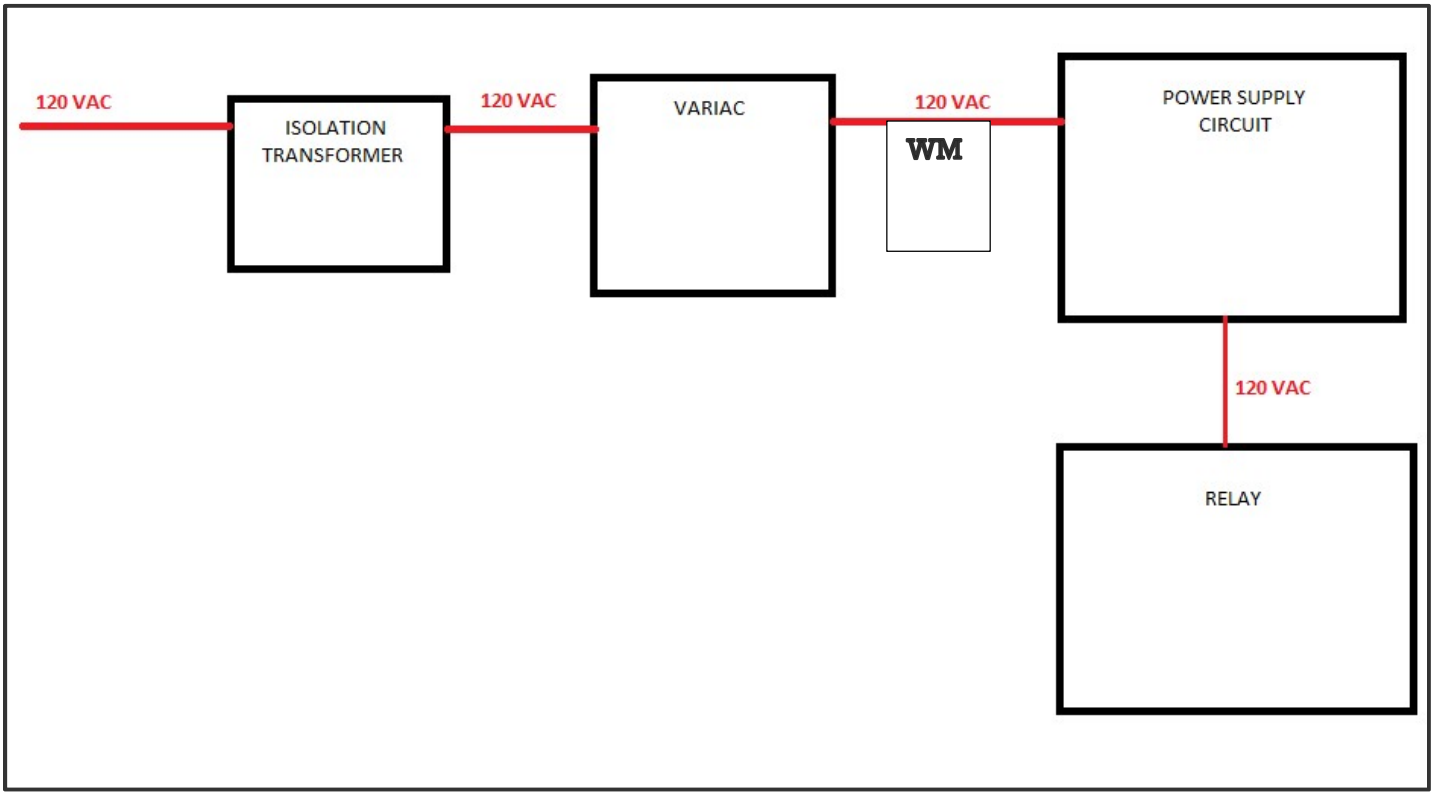
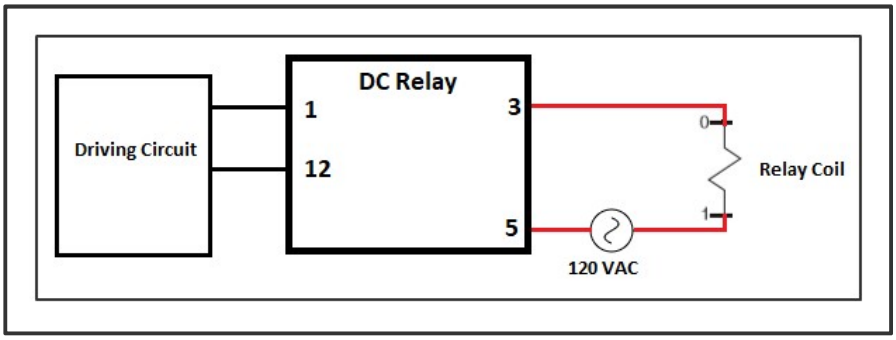


Figure 1.2: 120 VAC Safety Circuit Block Diagram

Note: - See figure 1.1 for power supply circuit schematic

Commissioning Plan: The commissioning is accomplished by testing each of the above-mentioned specifications.

Note: Make sure the **safety checklist for testing circuits involving 120 VAC** is completed before doing the following testing

S. No	TESTING STEP	Pass (Y/N)
1	**Input Supply:** Input supply is 120 VAC.	Y
2	**Power Supply Circuit:** Apply power to the circuit constructed during the safety checklist review. Slowly increase the voltage of the variac to 120 VAC (Make sure to monitor the voltage on the wattmeter). Check the output of the Power Supply Module using a DMM in DC Volts mode: • ~3.3V – Pass • < or > 3.3V – Fail **Results:** The output was analyzed using the oscilloscope. The voltage was found to be 3.3V with +/- 30 mV_{P-P} ripple. A 220 nF capacitor was added on the output which reduced the ripple voltage to +/- 15 mV_{P-P}	Y
3	**Switching Circuit**: In order to test the switching circuit, Connect the 120 VAC supply to the AC Relay Coil circuit as shown below:  Apply 3.3V from the DC power supply to the control input of J02 connector (Pin 3). The AC contact will close and a click can be heard which means the test is passed **Results:** As soon as 3.3V was applied to the base of the BJT transistor, the AC Relay was heard energizing confirming the working of the circuit.	Y