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**EMS**

**LAB REPORT #1**

**19L-1316**

**EXPERIMENT 1**

**INTRODUCTION TO ELECTROMECHANICAL SYSTEMS LAB AND EQUIPMENT**

**INTRODUCTION:**

**Electromechanical systems** or devices convert electrical energy into mechanical movement - and sometimes vice versa. Most of the common **electromechanical** components, such as electric motors and solenoids are used in combination with mechanical parts to provide actuation or movement.

**“These are based on the mechanical interaction between currents, between a current and a magnetic field, or between electrified conductors.”**

**OBJECTIVE:**

* To become familiar with different modules of EMS trainer and all other equipment and devices used in this lab.
* Continue to develop and synthesize analytical skills in the specification, procurement, or integration of electromechanical systems.
* Apply empirical skills in the safe operation, testing, or maintenance of electromechanical systems.
* The **aim** of this research is to develop advanced controllers for **electromechanical** motion **systems.**

**APPLICATION:**

* **Electro-mechanical system** applications are used for these technologies that are evident in sophisticated motion control and hand-held electronic/photographic devices, **micro electro mechanical systems** (MEMS), vehicles, and vehicle subsystems.
* Automation systems for production units using PLC, touch screen, computer, and industrial instruments.
* Automation systems for water resources exploitation projects (dams, pumping stations, wastewater treatment plants).
* Control systems of the production process in industrial plants.
* Remote monitoring and remote control systems using RADIO - GSM modems.
* Modernization of industrial units with PLC.

**PROCEDURE:**

* **AC AND DC SUPPLIES**
* The first three modules are the AC and DC supplies that are assembled to a single large module.
* These include the three-phase supply too, which is available in both separated three phases and the combined three phase supply with a single neutral.
* The ratings of the different supplies are indicated in the module.

Three Phase and Single-Phase Power Supply module available in lab is given in Figure 1.1



* **DC VOLTMETER AND DC AMMETER**
* The fourth module consists of DC voltmeters and DC Ammeters.
* One must keep in mind that Voltmeters are connected in parallel and the ammeters are connected in series.

DC Ammeter and DC Voltmeter module available in lab in shown in Figure 1.2



* **AC POWER AND POWER FACTOR METER**
* As the name depicts, the AC Power and Power factor meter is used to determine these parameters of your circuit.
* One must know that the term power factor is defined only for AC.
* There are separate fuses which are attached to the devices in order to take care of the safety.

The AC Power and Power factor meter available in lab is shown in Figure 1.3



* **AC VOLTMETER AND AC AMMETER**
* This module consists of AC voltmeters and AC Ammeters.
* One must keep in mind that Voltmeters are connected in parallel and the ammeters are connected in series.
* Ratings of voltmeters and ammeters are mentioned on the respective module.

This module is shown in Figure 1.4



* **THREE PHASE VARIABLE RESISTOR**

The three-phase variable resistor is used where we need a resistance that can be varied so that we could observe the behavior of our parameters with respect to that of changing the resistor.

The three-phase module is shown in Figure 1.5



* **VARIABLE RESISTOR**
* The variable resistor is an important part of the circuitry.
* It can be used for inserting an extra resistance and then varies it when required.
* Whenever we have to control the current we can insert a resistance.

Variable Resistor module is shown in Figure 1.6



* **AC CONTACTORS**
* A contactor is an electrically controlled switch.
* It is used for switching a power circuit similar to the relay except with the higher current ratings.
* Contactors typically have multiple contacts,
* And those contacts are usually normally open, so that power to the circuit is shut off, when the coil is de-energized.
* They are used to control electric motors, lighting, heating, capacitor banks and other electric loads.

The AC contactors module is shown in Figure 1.7



* **THERMAL RELAY**
* Thermal relay is an electrical protection device.
* It is designed to disconnect the load from its power supply to avoid any damage by sensing the heat produced from the flow of current.
* It consists of bi metallic strip.
* The basic principle of thermal relay is that when it is heated by the coil carrying over current of the system, it bends and makes normally open contacts.

Thermal Relay Module is shown in Figure 1.8



* **FUSE AND BUTTON SWITCH**
* A Fuse is a low resistance wire.
* It acts as a sacrificial device to provide the over current protection.
* It interrupts the excessive current so that further damage from over current or heating can be prevented.
* Button switch is a simple switch used for controlling some aspects of machine or process.
* They are made of hard material such as plastic or metal and their surface is such that to accommodate the human finger or hand so that it can be easily pressed or pushed to make or break the circuit.

This Module is shown in Figure 1.9



* **TRAVEL SWITCH AND TIME RELAY**
* Time relay exhibit the property of time delay actuation.
* Sometimes, momentarily faults occur in the power system, which automatically vanishes after few seconds.
* Hence to avoid the tripping of circuit in case of the momentarily faults, time relays are used.
* Time-delay relay contacts must be specified not only as either normally-open or normally-closed, but whether the delay operates in the direction of closing or in the direction of opening.

The Module comprising Travel Switch and Time Relay is shown in Figure 1.10



* **SWITCH, FUSE, INDICATOR LIGHT AND LAMP**
* Switches used to connect or disconnect the circuit manually.
* A Fuse is a low resistance wire that acts as a sacrificial device to provide the over current protection.
* It interrupts the excessive current so that further damage from over current or heating can be prevented.
* Indicator light or lamp is a small device which shows whether the power is on or off.
* When the circuit is closed, it will glow, otherwise it will not.

This Module is shown in Figure 1.11



**ISSUE:**

Faced little issue in understanding because we cannot saw devices since before.

**CONCLUSION:**

Nanoelectromechanical system is used to measure the very small asses and forces.

It also promises to be an effective technique of producing sensors of high quality at low cost**.**

**POST LAB QUESTIONS**

* **What is the use of CTs and PTs?**

These are the two electrical sensors i.e., **CTs and PTs** .The **CTs** current transformer is mainly used for measuring such magnitude of current that the **meter** or instrument cannot conveniently be measured whereas the **PTs** potential transformer is used for measuring the high voltage of the current.

**USES OF CTs and PTs:**

* **CTs** and **PTs** are needed because the circuit's current is much higher than the relay can handle. **PTs and** **CTs** step down the current to a low level safe to connect to the relay.
* These two electrical sensors are **used** in the power industry are potential transformers (**PTs**) and current transformers (**CTs**).

|  |  |
| --- | --- |
| **CTS** | **PTS** |



**2. How we can measure high DC voltages and currents?**

**High dc voltages** are usually **measured** by connecting a very **high** resistance (few hundreds or Mega ohms) in series with a micro ammeter. **Current I** flowing through large calibrated resistance R is **measured** by Moving Coil Micro ammeter.

**3. Differentiate between fuse and circuit breaker?**

|  |  |
| --- | --- |
| **FUSE** | **CIRCUIT BREAKER** |
| The **Fuse** provides protection against only power overloads. | **Circuit Breaker** provides protection for both power overloads and short **circuits**. |
| The **Fuse** provides both detection and interruption process. | **Circuit breaker** performs only interruption; a relay system is attached for detection of any fault in the **circuit**. |
| Breaking capacity of the fuse is low as compared to that of a Circuit Breaker. | Breaking capacity of the circuit breaker is high as compared to that of a fuse. |
| The cost of the fuse is low. | Circuit Breakers are more costly. |

