Experiment:1

Working and Characteristics of Various Types of Meters.

EQUIPMENTS

- Clamp meter (UT202)
- Lux Meter (TM-201)
- Anemometer (UT-361)
- Tachometer (UT-372)
- Megger(1010T)
- Phase sequence meter (YF-80)

THEORY

Clamp meter:

A clamp meter is an electrical test tool that combines a basic digital multimeter with a current sensor. Clamps measure current. Probes measure voltage. Having a hinged jaw integrated into an electrical meter allows technicians to clamp the jaws around a wire, cable or other conductor at any point in an electrical system, then measure current in that circuit without disconnecting it.

Beneath their plastic moldings, hard jaws consist of ferrite iron and are engineered to detect, concentrate and measure the magnetic field being generated by current as it flows through a conductor.

Figure 1.1 (Clamp meter)

Specification:

1. Current-sensing jaw.
2. Tactile barrier (to protect fingers from shocks).
3. Hold button: Freezes the display reading.
4. Dial (aka rotary switch).
5. Display.
6. Backlight button.

7. Min Max button: On first push, display shows maximum input. On subsequent pushes, minimum and average inputs are shown. Works in current, voltage and frequency modes.
8. Inrush current button.
9. Zero button (yellow): Removes dc offset from dc current measurements. Also serves as dial's shift button to select yellow functions scattered around the dial.
10. Jaw release lever.
11. Alignment marks: To meet accuracy specifications.
12. Common input jack.
13. Volts/ohm input jack.
14. Input for flexible current probe.

LUX Meter:

A light meter/lux meter is a device used to measure the amount of light falling on an object at area. In other words, it properly gauges the intensity at which brightness appears to the human eye. Lux can be simply defined as a unit of measurement of illuminance or more accurately, brightness. It derives its name from the candela, which is the standard unit of measurement for the power of light. There are many benefits of using lux meters. Firstly, they provide a quantified measurement of the amount of light available without which you are simply guessing.

Secondly, with a *lux meter*, you can clearly see and compare the impacts of different lighting conditions. A lux meter works by making use of a photo cell to capture light. The lux meter then converts this light to an electrical current stream, and after measuring this current, allows the device to calculate the lux value of the light it has captured.

Figure 1.2 (Lux meter)

Description	TM-201
Data Hold	Yes
Max Hold	Yes
Zero adjustment	Yes
Sensor	Siicon photodiode and filter
Measuring range	200, 2000, 20000, 200000 Lux
Accuracy	±3% (Calibrated to standard incandescent lamp 2856°K)
Angle deviation from cosline characteristics	30°-±2%
Weight (Gross)	0.50kg

Table 1.1 (Specifications of Lux meter)

You are probably familiar with the Lumen; this is the measure of light intensity people have generally heard of. The base unit of luminous intensity is the candela, (a single lit candle gives off roughly 1 candela). One candela per steradian (an area in a cone shape starting from the source of light) is known as a lumen.

When we measure light, we are interested in how many Lumens fall on a surface; this is what we know as lux. One lux is one lumen per square meter.

A working example, we have a light source whose total light produced (luminous flux) is 1000 lumens. If we could focus this onto the surface of 1 square meter we would have an illuminance of 1000 lux. However, if the same light was spread out over 10 square meters, we would only have an illuminance of 100 lux.

Examples of light levels	
Very Bright Summer Day	100,000 Lux
Full Daylight	10,000 Lux
Overcast Summer Day	1,000 Lux
Very Dark Day	100 Lux
Twilight	10 Lux
Full Moon	< 1 Lux

Table 1.2 (Examples of Light Levels)

Anemometer:

An anemometer is the instrument used to measures wind speed. Indoors, an anemometer measures air speed, air velocity or air flow. The air flow rate in buildings is often measured in cubic feet per minute (CFM) using an anemometer to assess the performance of heating, ventilation and air conditioning (HVAC) systems and equipment. The simplified scale used for prediction as following,

Wind Speed (KmPH)	Term	Description
0-5	Calm	Smoke goes straight up
6-20	Light	Wind is felt on face; weather vanes turn, leaves rustle
21-39	Moderate	Raises dust; flags flap
40-61	Strong	Large branches move; umbrellas turn inside out
62 or more	Gale / Whole Gale	

Table 1.3 (Scale for prediction)

Figure 1.3 (Anemometer)

Specification:

1. Data Hold: Display"H"
2. Wind Speed/Wind Count Display: Display "VEL/FLOW"
3. Max / Min Mode: Display "Max" or "2/3 Max"
4. Sleep Mode: Around 10 Minutes
5. Working Temperature: 0 ~ 40°C
6. Deposited Temperature: -10 ~ 55°C (14°F ~ 122°F)
7. Low Battery Display: < 7.2V
8. Relative Humidity: < 7.5%

Tachometer:

A tachometer is an instrument measuring the rotation speed of a shaft or disk, as in a motor or other machine. The device usually displays the revolutions per minute on a calibrated analogue dial, but digital displays are increasingly common. Digital tachometers can measure low-speeds at 0.5 rpm and high speed at 10,000 rpm and are equipped with a storage pocket for the circumferential measurement. The specifications of this tachometer are LCD 5-digit display, operational temperature range of 0 to + 40 C, temperature storage range of – 20 to + 55 C.

Figure 1.4 (Tachometer)

Specification:

1. Measurements of RPM with no contact
2. Recommended measurement distance of 50mm to 200mm
3. MAX/MIN/AVG functions
4. Data hold function
5. Four measurement ranges: 10-99RPM; 100-999RPM; 1000-9999RPM and 10000RPM-99999RPM
6. Revolution counter function with range of 0 to 99999
7. Auto shut down when left idle
8. Low battery indicator

Megger:

Megohmmeter or megger is a special type of ohmmeter used to measure the electrical resistance of insulators. Insulating components, for example cable jackets, must be tested for their insulation strength at the time of commissioning and as part of maintenance of high voltage electrical equipment and installations. For this purpose, megohmmeters, which can provide high DC voltages (typically in ranges from 500 V to 5 kV, some are up to 15 kV) at specified current capacity, are used. Acceptable insulator resistance values are typically 1 to 10 megohms, depending on the standards referenced.

Figure 1.5 (Megger)

Specification:

1. The tester consists of a hand-driven high voltage
2. DC generator and an internal magnet cross coil current ratio meter.
3. The hand-driven generator is equipped with a centrifugal governor which enables the rotor to rotate with constant speed for containing
4. Steady output voltage
5. Cranking speed: 120rpm
6. Damping time: Within 4 second
7. Effective measuring: 0-1000V/1000MOhm

Phase Sequence Meter:

The phase rotation or phase sequence measurement is needed when connecting three phase supplies to electrical drives, electrical motors and other electrical systems.

Phase sequence meters show the correctness of three phase connection to loads. If the phase sequence is not in a correct manner, it will lead to malfunction of load systems. Phase rotation indication by both audio and indicator, checking if currents of three different rating are in proper phase. Phase open-circuit detection by indicator.

Figure 1.6 (Phase Sequence Meter)

CONCLUSION

Instructor Signature: _____ **Date: _____**