

Easy Measurement Equipment

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Abstract

The problem faced in measuring process in electrical wiring bay has brought the idea of developing a special measurement equipment for domestic wiring used. The ordinary measuring equipment usually has one standalone function such as when drawing a straight line, user will need to use a ruler together with water level to get an appropriate schematic drawing. The system works according to the equipment in order to accomplish the task needed that will lead to cost increment. The present invention discloses of single measuring equipment with multiple usage of measurement. The scale of the ruler makes measurement of length can be done easily and very much helpful with the attachable water level. Moreover, measurement of various angles solved by the appearance of angle measurement and the unique L-shape at one end of the equipment makes angle of 90 degree ready on the go to be used. This study aims to design and build an easy measuring equipment to set the angle indicator. The system works according to the angle at 45-degree, 135-degree and 90-degrees. The angles are determined by the typical angle that is used to draw the circuit in the laboratory. The best part of the invention is design holes at both ends to simply help user in measuring cables quickly. The multipurpose measuring equipment was successfully designed and tested.

Keywords: - measurement, equipment, ruler, L-shape, angle, wiring

1 Introduction

Measuring tools such as ruler and protractor is becoming a necessity for university students in skills, especially to those studying in the electric course and it is in line with current lifestyle requires existing products available and easy to use.

Thus, a simple device was designed for angle measurement. All functions are available on an equipment that is a measuring ruler with the length of approximately 100m. In addition, the ruler has an additional unique function that can be used in the laboratory for electrical wiring such as cable distribution, water level and L-shape for fast drawing measurement of 90 degrees.

Domestic wiring installation in house or industrial building is one way to deliver electricity to the people. For the technical students or workers, they need to have basic knowledge in schematic wiring drawing and in fact be able to draw the basic drawing by using multiple measuring equipment's. Over the years, electrical design has moved from scratch paper to drafting schematics to using CAD software (Mbunwe et al., 2020).

Practically the measuring equipment's are usually used in laboratory class by the students and trainer. Figures 1, 2, 3, and 4 show a measurement that is routinely performed: measuring distance with a meter ruler and a water level indicator, as well as a basic wiring diagram on a wiring bay that relates to a particular angle of household electrical

wiring.

To avoid any waste behavior, the trainer must arrange the tools, components, and distribute cables to the students with appropriate lengths each time the practical lesson is held. The trainer will need a good measuring instrument as a result of this deed, but it will take more time to distribute the wires to a large number of students, reducing time for the students wiring class. Some of the technical workers still using ruler or measuring tape with water level when doing domestic building wiring. We're hardly strangers to measuring tape. In the surveying sector, it is in high demand. There are numerous measuring tape designs available on the market right now (Effendi et al., 2021). Therefore, the existing of one measurement equipment embedded with the use of a ruler, water level, protractor and cable measuring tools are practically needed.



Figure 1: A one-meter ruler



Figure 2: Measuring tape



Figure 3: Water level

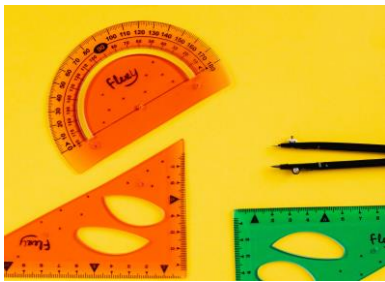


Figure 4: Angle measurement equipment

2. Literature Review

Measurement is the process of acquiring data and comparing it to predetermined standards. Aside from that, measurements are important activities for observing, testing, and performing tasks with instruments that are designed and built to complete certain tasks (Webster and Eren, 2014).

New instruments and measurement techniques were developed throughout the Industrial Revolution in the nineteenth century to meet the needs of industrialised production practises (Morris, 2001). As a result, a variety of measurement equipment have been developed to improve the user's functionality. People of the Peking and Neanderthal epochs, for example, had implements made from materials specifically determined to be the proper length or weight for a certain use, and a tool that worked well became the model and standard for another (Katz, 2004).

A measuring tape is commonly used to determine the length of an electrical wire, although it is difficult to accurately measure the length of cable (Sun, 2012).

The Building Construction measuring tape is highly useful on static buildings to show optimum positioning, and this measuring device eliminates the need for manual measurement with minimal stretch, is easily useable by a single worker, and does not require the use of other measuring devices. This measuring tape is used in the construction of buildings and other static structures (Troyer and Reeke, 1979).

The purpose of the water level design is to measure the vertical displacement of a structure, which is crucial in determining the structure's short and long-term behaviour as well as ensuring its safety. Devices with two glass pipes connected by a flexible hose filled with liquid or widely used water that are used on construction sites. For the observation of structures, this equipment is insufficiently accurate (Marecos, 1978).

The “Angular Measuring and Saw Angle Setting Device” is a tool for determining accurate corner angles in trim and other carpentry applications. The gadget is used for geometrical angular measuring in order to offer saw angular settings in carpentry work that are only between 0 and 90 degrees (Akyuz, 2016).

3. Methodology

3.1 Design of Angle Selector for Easy Measurement Equipment (EME)

Figure 5 shows how the design uses a protractor to indicate an angle indicator, such as a 45-degree measurement angle, while the end of the ruler is designed for a 90-degree measurement angle.

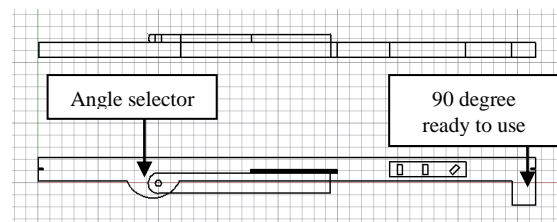


Figure 5: Design of angle selector using protractor and 90 degree ready to use

3.2 Parts of Easy Measurement Equipment (EME)

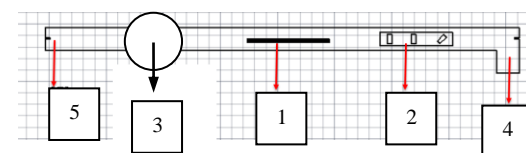


Figure 6: Six special parts of EME

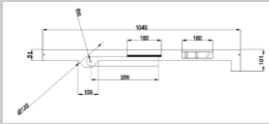
Figure 6 indicates five major parts for EME. From the diagram, there are a holder (1), water level (2), angle measurement (3), L-shape end for

90 degrees ready to use (4) and both end of this equipment for measuring cable as easily in short time (5) also the cables measure per loop using EME is approximately two meters.

3.3 EME Specifications

The EME requirements are summarised in Table 1. Students, educators, trainers, and even technical wire professionals will benefit from the product. The material used in this product is acrylic.

Table 1: EME design specification.

BIL		HARDWARE DESIGN SPECIFICATION
1	Name of product	Easy Measurement Equipment (E.M.E)
2	Utility of the product	E.M.E help students, educators, trainers and even technical wiring workers because it comes with many functions.
3	Design specification	
		Material :- Acrylic (transparent Thermoplastic) - Light-weight - transportable - Not easily damaged by impact. Size : 80mm Ergonomics : Must be convenient to handle and store, easy to use, and be capable of set up by one person
4	Safety design	Should not have sharp projections

4. Finding and Analysis

The overall project hardware for the development of EME. is shown in Figure 7. The L-shape for 90-degree angle and hole for cable measurement distribution can be observed in

Figure 88. A hole measurement cable is also included for distribution to students. Then there's a water level attachment for vertical and horizontal lines, as well as angle measurements at 90 and 45 degrees.

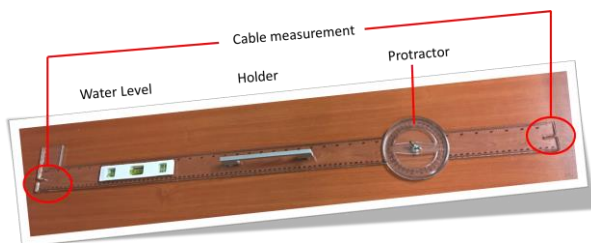


Figure 7: The development of EME using acrylic as a material

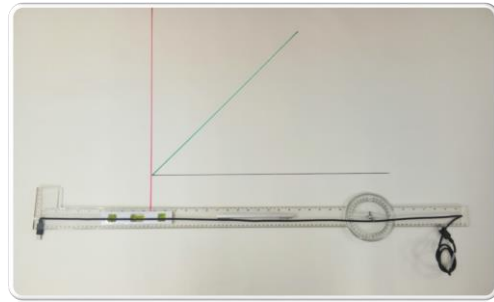


Figure 8: L-Shape and cable measurement distribution



Figure 9: The development of EME using trunking PVC cover as a material



Figure 10: At the wiring bay, a student uses a measuring tape and a water level to draw a line and measure an angle



Figure 11: For cable distribution, students use measuring tape

The measuring tape is one of the most useful tools. It's necessary for every building or restoration project, and it's also utilized for tailoring and body measures (Dhakiphale et al., 2020). Figure 10 shows the student drawing a line and measuring an angle at the wiring bay with a measuring tape and a water level. Students use the equipment on their own. From Figure 11 shows that the student use measuring tape for cable

distribution.

Students, on the other hand, will need the equipment to draw a straight line after measuring using a measuring tape. Furthermore, because the equipment is separate, students face the risk of losing it. Aside from that, the student uses a measuring tape to take time for cable distribution.



Figure 12: Student use EME as a ruler and create a line and an angle measurement using the built-in water level



Figure 13: EME is used by students to measure an angle



Figure 14: EME is used by students to quickly distribute cable

Figure 12 and 13 shows a student drawing and measuring a line at the wiring bay using EME as a ruler. Aside from that, students must use EME's built-in water level or angle measurement equipment for angle measurement.

Students utilize EME to quickly distribute cable, as seen in Figure 14. The cables measured each loop using EME is around two meters.

In practical class, the students employed EME from a trunking PVC cover, as shown in Figure 9, which was reused after the students finished the practical classes. In addition, a commercially viable EME sample composed of acrylic material, as shown in Figure 7, has been constructed.

5. Conclusion

Easy measurement equipment consists of five functions in one product as a main part; linear measurement, angle measurement, water level, L-shape end and both ends to measure a cable. The project of Easy Measurement Equipment or so called as EME being held to help in reducing the wasting of cost, time and designing one simple measuring tools that help students, educators, trainers and even technical wiring workers because it comes with added values.

The cost of this system is low cost under RM 500.00. If the system produces in large quantities, the cost of production can be reduced. As a conclusion, the project was successfully done, and some promising results were produced.

There are various areas in the design of an Easy Measurement Equipment that need to be enhanced in order for the project to perform properly. These components are protractor parts that are used to measure angles and have a light acrylic main body.

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