DIGITIZED MEASURING WHEEL FOR COMPUTING SIGNAL LOSSES DUE TO CABLE LENGTH

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ABSTRACT

The device solves the problem of determining the location of amplifiers in a cable television network and a telephone network. The device has a wheel with sensor attach to it to send pulses to the microcontroller equivalent to a certain distance traveled by the wheel. The microcontroller also accepts the attenuation factor per unit length available in the coaxial cable specification to be multiplied by the distance covered by the wheel and result in accumulated attenuation or losses produced by the cable at that length. This were all done through the microcontroller. Another important parameter which can be input through the keypad towards the microcontroller is the threshold value of attenuation wherein the signal is no longer usable and needs amplification this will create an audible alarm that identify the location of the amplifier. This device will be beneficial in planning of distribution design for cable television using coaxial cable. This is also use for estimating accumulated losses due to cable length for telephone network which still uses coax and data network that uses copper.

KEY WORDS: Microcontroller, Coaxial Cable, attenuation, threshold value, distribution design.

INTRODUCTION

The attenuation is directly proportional to the cable length in the Distribution system of cable television. Thus, there is a need to use accurate and convenient distance measuring devices to have a well-designed Cable TV distribution. There are three existing devices in measuring distances for the distribution or feeder network: measuring tape, measuring wheel, and digitized display measuring wheel. The researcher used the measuring tape during the surveying of the expansion of the network of the Cable operator wherein the researcher conducted his immersion. Although there is a mechanical measuring wheel working in similar principle with the vehicle odometer. Numerous automation have been introduced in this field of distance measuring equipment combining the convenience of mechanical measuring wheel and accuracy of the measuring tape. However, there is no existing device that measures distance and then automatically calculates the corresponding attenuation. Also there is a need for a device that will adapt the convenience created by mechanical measuring wheel and accuracy of measuring tape.

The mechanization of these devices will minimize delay of measurement of distances that will create much convenience on the staff involved in surveying. Another improvement of the digitized measuring wheel will eliminate repetitive calculations of attenuations because instead of manually computing each variable span of distances between poles will automatically display the results. Distances in meters can be converted to equivalent losses in dB to estimate the value of directional taps needed at the poles to maintain the minimum signal requirement of 5 -8 dBmv at the output of each tap. The device will determine when to put up extender amplifiers. At the drop line, the minimum requirement at the subscriber’s TV receiver is 0 dBmv. The requirement for
clear viewing is 0 dBmV. To sum up, there should be an accurate, convenient and easy to use device in measuring distances and corresponding attenuations of signals to have a pair Distribution Design.

**OBJECTIVE OF THE STUDY**

**General Objective**

The study aims to develop a Digitized Measuring wheel to avoid repetitive computation of attenuation of cable and to determine the location of amplifiers, values of directional taps, and passive devices. It also aims to validate the accuracy of the reading by testing the device in a subscriber area and compare the results to measuring tape readings.

**Specific Objectives**

i. To design the device encoder circuits that accumulates pulses by rotating the wheel.

ii. To design the wiring of microcontroller and program according to the inputs and produce the required outputs.

iii. To design the display circuits to enable to accept inputs from the microcontroller and display the traveled distance by the wheel and attenuation as calculated by the microcontroller.

iv. To design the handle and base assembly for the microcontroller batteries and display.

v. To design the keypad inputs to enable it to input attenuation constant in the microcontroller, depending on the specifications of cable use.

vi. To test and compare the results of the measurement to the traditional measuring wheel and determine the validity of the device.

**Figure 1**: Schematic Diagram.

Figure 1 shows the several parts of the device from shaft encoder and keypad matrix as inputs to the microcontroller and the display circuits of attenuation and distance traveled. Figure 2 shows the actual device and shows the improvised PVC handle to minimize the cost of fabricating the device.

**Figure 2**: The digitized measuring wheel

**SIGNIFICANCE OF THE STUDY**

The study will be beneficial in the following ways:

i. The Technicians deployed in the surveying will save time and effort in accomplishing their task of measuring distances between poles.

ii. The CATV engineers that will save time in computing attenuation due to cables and determine the value of directional taps.

iii. To the future researchers that will dwell on the field of instrumentation and automation.

**METHODOLOGY**

The study uses the descriptive method of research, using the findings from previous studies and existing devices in this field. The inputs are literature from previous studies, existing devices and interview from practitioners. The process involves a development of the circuits and mechanisms for counting the distances travelled by the wheel as well as programming of microcontroller to compute distances traveled and attenuation accumulated. To validate the accuracy of measurement the device output has been compared to the tape measure and revised when accuracy was not acceptable. The output of the research is the digitized measuring wheel.
CONCEPTUAL MODEL OF STUDY

RESULTS AND DISCUSSIONS

The following are the critical findings in conducting the study.

i. The tape measure consumes 5 hours in surveying the entire site while the improved device takes 2 hours.
ii. The automated device eliminates the hassle of rolling the tape then unrolling back the tape.
iii. The automated device automatically computes the high pilot and low pilot attenuation based on the accumulated distance measured.
iv. The device displays the attenuation as well as distance in meters.
v. The device can trigger an alarm by inputting a value to the keypad known as the threshold level.

During the actual testing of the prototype in a particular potential installation site, the data obtained was compare to data obtained using the tape measure. Table 1 provides the comparison of the distance measured using the digitized measuring wheel and tape measure.

Table 1: Distance reading using Tape Measure and the Device.

<table>
<thead>
<tr>
<th>Reading (meters) using Device</th>
<th>Reading using tape measure (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.80</td>
<td>29</td>
</tr>
<tr>
<td>26.70</td>
<td>27</td>
</tr>
<tr>
<td>36.30</td>
<td>37</td>
</tr>
<tr>
<td>46.40</td>
<td>53</td>
</tr>
<tr>
<td>38.30</td>
<td>42</td>
</tr>
<tr>
<td>22.00</td>
<td>25</td>
</tr>
<tr>
<td>33.20</td>
<td>35</td>
</tr>
<tr>
<td>30.00</td>
<td>33</td>
</tr>
<tr>
<td>41.40</td>
<td>46</td>
</tr>
<tr>
<td>36.90</td>
<td>41</td>
</tr>
<tr>
<td>30.60</td>
<td>34</td>
</tr>
<tr>
<td>25.20</td>
<td>28</td>
</tr>
<tr>
<td>44.10</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 2: Percent Differences of Distance and attenuation readings using the device and tape measure.

<table>
<thead>
<tr>
<th>Distance Reading (Percent Difference)</th>
<th>High Pilot attenuation reading (Percent Differences)</th>
<th>Low Pilot attenuation reading (Percent Differences)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.69</td>
<td>0.69</td>
<td>0.69</td>
</tr>
<tr>
<td>1.12</td>
<td>1.12</td>
<td>1.12</td>
</tr>
<tr>
<td>1.90</td>
<td>1.90</td>
<td>1.92</td>
</tr>
<tr>
<td>14.33</td>
<td>14.33</td>
<td>14.22</td>
</tr>
<tr>
<td>9.66</td>
<td>9.66</td>
<td>9.66</td>
</tr>
</tbody>
</table>

Table 2 shows the results of attenuation and distance reading the comparison regarding their percent differences. The data gathered from a segment of a potential installation site. There are two attenuations measured, high pilot frequency and low pilot frequency. For the tape measure, this was manually computed based on cable specifications and distance reading. For the digitized measuring wheel attenuation factor was inputted and automatically computes by the device.

CONCLUSIONS

By the aforementioned findings, the following conclusions are drawn.

i. The digitized measuring wheel reduces the measurement time by more than 50% of the time in the measurements as compare in measuring of distances using the tape measure.
ii. The device speeds up computations by automatically computing and displaying the corresponding attenuations of distances between poles.
iii. The device determines when to put extender amplifier by comparing the threshold value inputted through the keypad and accumulated attenuations reading.

RECOMMENDATIONS

Based on preceding and conclusions, the following recommendations are suggested to improve the prototype:

i. The automated device is advisable to be used in planning a distribution system since it minimized repetitive computations.
ii. The automated device added feature of alarm on the instance of placement of amplifiers make this advisable for surveying site.
iii. Future researchers may improve the device by distinguishing forward and reverse movement of the wheel.
iv. Future researchers may improve the accuracy of the prototype in rough road.

REFERENCES