

[0076] Since the cross section length can be approximated by the product of the distance and sine of the cut-off angle, the cross section lengths D1 and D2 are measurable according to equations (10) and (11) below.

$$D1=r1 \cdot \text{sind}(\theta)=(Pcx^2+Pcy^2)^{1/2} \cdot \text{sind}\theta \quad (10)$$

$$D2=r2 \cdot \text{sind}\phi=\{(L \cdot Pcx)^2+Pcy^2\}^{1/2} \cdot \text{sind}\phi \quad (11)$$

[0077] Further, when  $\theta$  and  $\phi \approx 0$ , it is possible to approximate  $\text{sind}\theta \approx d\theta \approx \text{tand}\theta$  and  $\text{sind}\phi \approx d\phi \approx \text{tand}\phi$ , and therefore  $d\theta$  or  $\text{tand}\theta$ , or  $d\phi$  or  $\text{tand}\phi$  may be substituted for  $\text{sind}\theta$  and  $\text{sind}\phi$  in equations (10) and (11).

#### INDUSTRIAL APPLICABILITY

[0078] As described above, in the optical scanning-type touch panel of the present invention, since the threshold value used as a criterion in judging whether a cut-off region is formed by the indicator is varied according to the scanning angle, it is possible to eliminate the effect of the directly incident light on the light receiving elements and calculate the accurate cut-off region, and thereby providing highly accurate calculation results for the position and size of the indicator.

1. An optical scanning-type touch panel comprising:
  - a light retro-reflecting member disposed outside a predetermined area;
  - at least two light transmitting and receiving sections, each having an optical scanner for angularly scanning light in a plane substantially parallel to the predetermined area and a light receiving element for receiving reflected light from a portion of the light retro-reflecting member, which portion was illuminated with light;
  - a measuring section for measuring a scanning light cut-off region formed in the predetermined area by an indicator, based on a scanning angle of said optical scanner and a result of receiving light by said light receiving element;
  - a calculating section for calculating a position and size of the indicator according to a result of the measurement performed by said measuring section;
  - an angle detecting section for detecting an angle of the scanning light; and
  - a memory section for storing a plurality of reference values of different levels,

wherein said measuring section measures the scanning light cut-off region by comparing the result of receiving light by said light receiving element with one reference value selected from the plurality of reference values stored in said memory section according to the angle of the scanning light detected by said angle detecting section.

2. The optical scanning-type touch panel as set forth in claim 1,

wherein a large reference value is selected when the angle of the scanning light is small, and a small reference value is selected when the angle of the scanning light is large.

3. The optical scanning-type touch panel as set forth in claim 1,

wherein said angle detecting section includes an optical scanning start detector for detecting a start of optical scanning and a timer having the function of measuring time, and detects the angle of the scanning light according to an elapsed time measured by said timer from a time at which the start of optical scanning was detected by said optical scanning start detector.

4. The optical scanning-type touch panel as set forth in claim 2,

wherein said angle detecting section includes an optical scanning start detector for detecting a start of optical scanning and a timer having the function of measuring time, and detects the angle of the scanning light according to an elapsed time measured by said timer from a time at which the start of optical scanning is detected by said optical scanning start detector.

5. The optical scanning-type touch panel as set forth in claim 3,

wherein said optical scanning start detector detects timing of starting reception of light of not lower than a predetermined level by said light receiving element as the start of optical scanning.

6. The optical scanning-type touch panel as set forth in claim 4,

wherein said optical scanning start detector detects timing of starting reception of light of not lower than a predetermined level by said light receiving element as the start of optical scanning.

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