(12) UK Patent Application (19) GB (11) 2 309 780 (13) A

(43) Date of A Publication 06.08.1997

(21) Application No 9701699.2

(22) Date of Filing 28.01.1997

(30) Priority Data
(31) 19603553 (32) 01.02.1996 (33) DE

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(51) INT CL^6
B60S 1/02

(52) UK CL (Edition O)
G1A AG6 AG9 AMP AR7 AT2 AT21 AT27 AT5

(56) Documents Cited
GB 2208433 A WO 91/09756 A1

(58) Field of Search
UK CL (Edition O) G1A AMP ASA
INT CL^6 B60S 1/00 1/02 1/08
Online:WPI

(54) A device for operating a windscreen wiper

(57) The invention relates to a device for operating a windscreen wiper with an automatic wiper control which comprises a rain sensor with a light-emitting transmitter diode SD, a receiver ED which responds to the emitted light and transmits a sensor signal, and an evaluating device for the sensor signal comprising a micro computer. An evaluation of the sensor signal is achieved simply and reliably in that the evaluating device comprises at least one capacitor C, which is provided outside the micro computer and to which the sensor signal is supplied, a comparator K is connected to the capacitor, which comparator compares the voltage formed in the capacitor by the sensor signal with a threshold voltage, and transmits an output signal if the threshold voltage is exceeded, and the micro computer forms a measurement value from the output signal corresponding to a time when the threshold voltage is exceeded. The device does not respond to ambient light changes, e.g. caused by trees along an avenue.

FIG. 1

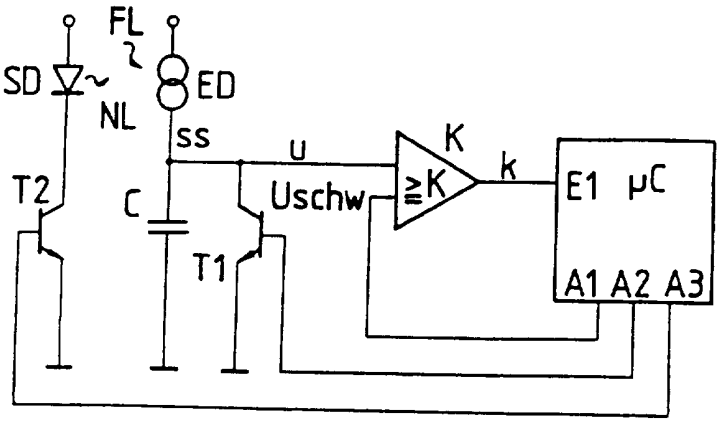

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FIG. 1

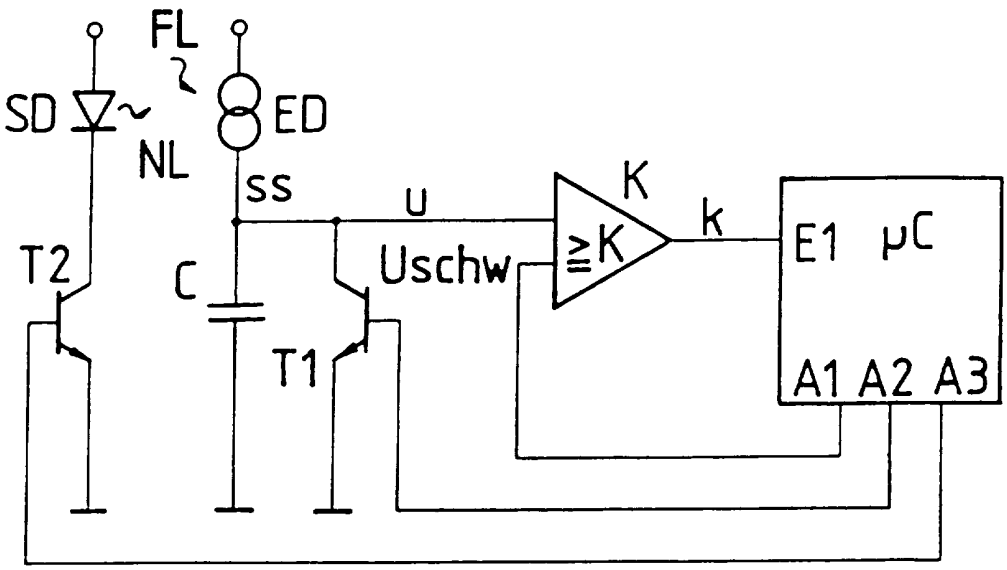
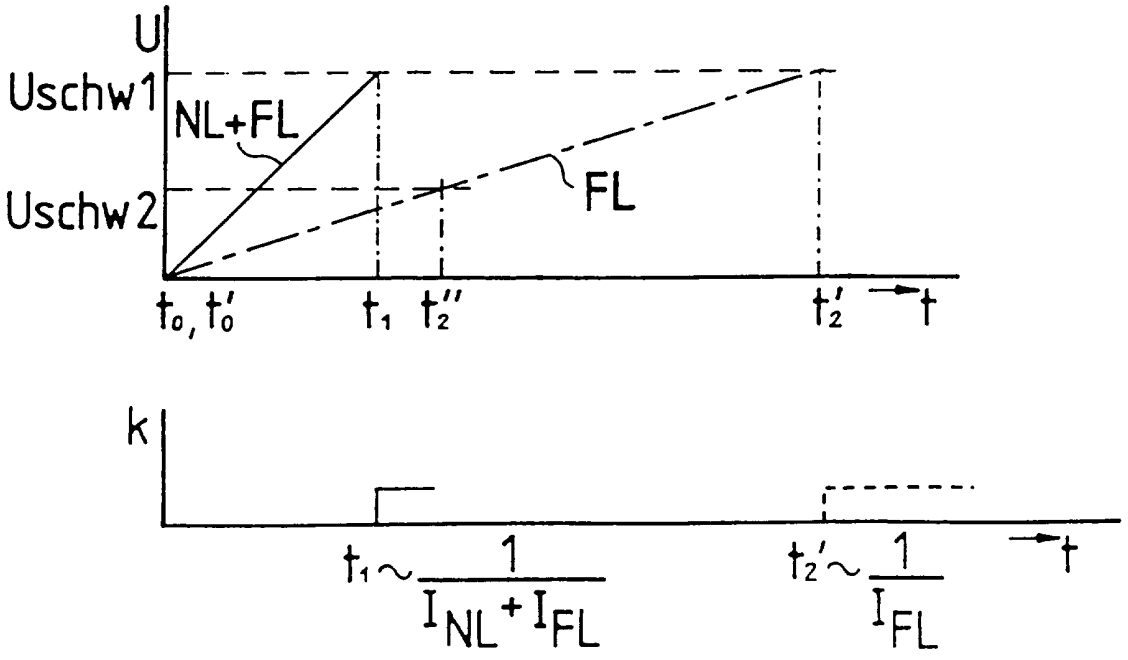

FL
SD
ED
NL
ss
u
K
≧K
k
T2
C
Uschw
E1 µC
T1
A1 A2 A3

FIG. 2


U
Uschw1
NL+FL
Uschw2
FL
t0, t0'
t1
t2''
t2'
t
k
t1 ~ 1 / INL + IFL
t2' ~ 1 / IFL
t

A device for operating a windscreen wiper

State of the art

The invention relates to a device for operating a windscreen wiper with an automatic wiper control, which comprises a rain sensor with a light-emitting transmitter, a receiver which responds to the emitted light and transmits a sensor signal, and an evaluating device for the sensor signal comprising a micro computer.

A device of this type is known from DE 33 14 770 A1. In this case, a useful signal is formed from the light coming from a light-emitting transmitter in that the light is conducted to a photoelectric receiver, different wetting events on the windscreen having a characteristic effect on the light reaching the receiver. Disturbances, such as foreign light influences, can overlie and falsify the useful light, which can result in defective behaviour of the automatic wiper control. In order to block out these types of falsifying foreign light influences, it is proposed in DE 33 17 770 A1 to pulse the light transmission from the transmitter in order to suppress disturbing influences. The evaluation necessitates a relatively high outlay for the wiper control.

A device for operating a windscreen wiper is also described in EP 0 460 180 B1, by means of which disturbances in the form of foreign light influences can be detected and eliminated. In this case, sample hold members are used and differences are formed in the evaluating device from the signals corresponding to the detected light.

In known automatic wiper controls of this type, micro computers are usually used, which comprise an integrated analogue-digital converter. Micro computers of this type are relatively expensive.

Advantages of the invention

It is the object of the invention to provide a device of the initially mentioned type, in which reliable control of the wiper operation is ensured at low cost, it being possible to eliminate disturbances, such as foreign light influences.

This object is attained by way of the features disclosed in claim 1. Accordingly, it is provided that the evaluating device comprises at least one capacitor, which is provided outside the micro computer and to which the sensor signal is supplied, a comparator is connected to the capacitor, which comparator compares the voltage formed in the capacitor by the sensor signal with a threshold voltage, and transmits an output signal if the threshold voltage is exceeded, and the micro computer forms a measurement value from the output signal corresponding to a time when the threshold voltage is exceeded.

In this manner, no expensive micro computer with integrated AD converter is required. Rather, the clear output signal of the comparator can be directly evaluated. The capacitor which is used is cost effective, since, amongst other things, the tolerances of the capacitor value are of no significance, given that the foreign light and useful light can be equally detected and separated from one another. As a result of the integral evaluating procedure, further disturbances (EMV) are identified. The signal resolution of the micro computer is increased as compared with the evaluation with AD converters, and the signal evaluation is more sensitive as a consequence. Signal amplification by an error-prone operation amplifier is dispensed with.

The determining of the times taken before the threshold is exceeded with the useful light alone and in the case of useful light with additionally present foreign light is reliably ensured in that a terminal of the capacitor leading to the receiver is connected to a first control element, which is located in the micro computer or outside the micro computer, and the capacitor can be discharged by actuating the first control element after the threshold voltage has been exceeded and can be recharged again following discharge. A simple construction with reliable functioning is obtained in that the transmitter can be actuated synchronously with a charging or recharging procedure of the capacitor in order to transmit light and synchronously with a subsequent recharging procedure in order to interrupt the light transmission via a further control element located in the micro computer or outside the micro computer. In this respect, it is expedient for the first and further control elements to be constructed as switching transistors.

If it is provided that different threshold voltages can be preselected by means of the micro computer, then the times which are to be measured can be laid within suitable time frames, if for example widely differing light influences are to be taken into account. The threshold voltages can be preselected using an internal or external voltage divider in that the micro computer selects the suitable voltage divider.

The determining of the useful light component is effected, for example, using simple means in a reliable manner in that the reciprocal values of the measured times can be formed in the micro computer and the respective measurement values can be formed therefrom, and the proportion of useful light coming from the transmitter can be distinguished from additionally penetrating foreign light.

The invention will be explained in further detail in the following with the aid of

an embodiment with reference to the drawings, in which:

Fig. 1 is a schematic circuit diagram of the basic parts present in the automatic wiper control and

Fig. 2 shows graphs explaining the signal evaluation.

Fig. 1 shows a transmitter in the form of a transmitter diode SD, which transmits light, of which a given proportion travels over an optical path, in which a section of a windscreen is contained, to a receiver in the form of a receiver diode ED. The receiver diode ED is connected with one terminal to supply voltage potential and with its other terminal via a capacitor C to earth. Connected between the receiver diode ED and the capacitor C is an input of a comparator K, whose output is connected to an input E1 of a micro computer μC. The other input of the comparator K is connected to a first output A1 of the micro computer μC. In addition, a control element in the form of a switching transistor T1 with its collector is connected between the receiver diode ED and the capacitor C, the emitter of the switching transistor T1 being connected to earth. The base of the switching transistor T1 is connected to a second output A2 of the micro computer μC. The transmitter diode SD is connected at its anode to supply voltage potential, whilst it is connected at its cathode to the collector of a second control element in the form of a controllable current catcher or a second switching transistor T2, whose emitter is connected to earth. The base of the second switching transistor T2 is connected to a third output A3 of the micro computer μC.

The receiver diode ED transmits a sensor signal ss, which is influenced by a wetting event, in that light is kept away from the windscreen in the light path between the transmitter diode SD and the receiver diode ED as a result of droplets impacting on the windscreen, for example, so that the sensor signal ss is

correspondingly weakened. Overlying the proportion of useful light NL received by the receiver diode ED is foreign light FL, which enters the windscreen, for example in the case of inclined light incidence, and may be modulated, for example when driving through an avenue, as a result of the frequent light change. This can result in considerable falsifications of the sensor signal ss, which can trigger the automatic wiper control by mistake. In order to ensure reliable evaluation of the useful light NL, the sensor signal ss is integrated with the capacitor C, so that a voltage u is formed, which is applied to the comparator K. If the voltage u exceeds a threshold voltage U_{schw} applied to the other input of the comparator K, then the comparator K transmits a corresponding signal to the micro computer μC. The micro computer μC transmits a control signal via the second output A2 to the switching transistor T1, which is thereby switched, so that the capacitor C is discharged. Subsequently, the current path via the switching transistor T1 is again interrupted by a corresponding control signal from the micro computer μC, so that the capacitor C is recharged. With the new charging procedure of the capacitor C the transmitter diode SD is switched off, in that a further control signal is transmitted by the micro computer μC to the second switching transistor T2, so that the current through the transmitter diode is interrupted. In this phase, the receiver diode ED merely receives foreign light FL, so that the capacitor C is merely charged by the current I_{FL} produced by the foreign light FL and the time taken until the threshold voltage U_{schw} is exceeded is merely dependent upon the foreign light FL.

Fig. 2 shows two charging procedures of the capacitor C over time t and the associated output signal k of the comparator K. At a moment in time t_0, a charging procedure of the capacitor C is started by means of the micro computer μC, both useful light NL and foreign light FL falling upon the receiver diode ED. At a moment in time t_1, the voltage u built up in the capacitor C exceeds the threshold voltage U_{schw1}. The transmitter diode SD is then switched off and a new charging

procedure of the capacitor C is begun at a point in time t_0'. In this respect, the transmitter diode SD is switched off so that only foreign light FL falls upon the receiver diode ED. Consequently, the capacitor C is charged more slowly, and the voltage u only exceeds the threshold voltage u_{schw1} at a point in time t_2'. At this point in time, as shown in the lower graph of Fig. 2, the comparator K transmits a corresponding output signal k to the micro computer μC. The time required for the charging cycle until the threshold is reached is inversely proportional to the respective current flux with which the capacitor C is charged, i.e. on the one hand to the sum of the current produced by the proportion of useful light NL and the current produced by the foreign light FL, and on the other hand to the current produced by the foreign light FL alone.

As can be seen from the upper graph in Fig. 2, a different threshold U_{schw2} can be set by means of the micro computer μC for the charging procedure using foreign light FL alone, in order to shorten the charging cycle, in particular in the case of a small quantity of foreign light, so that the threshold voltage U_{schw2} is exceeded, for example, at the point in time t_2''.

The reciprocal value is formed from the measured times in the micro computer μC and an evaluation is optionally carried out using suitable constants. By forming the difference between the reciprocal values of the times with and without useful light, the influence of the foreign light FL is completely eliminated, so that the signal which is obtained is solely dependent upon useful light NL, so that a reliable evaluation is obtained for determining the wetting state and for operating the automatic wiper control. The possibly different threshold voltages U_{schw1}, U_{schw2} are taken into account in the elimination of the foreign light influence.

The switching transistors T1, T2 of the comparator K and/or the voltage dividers for the adjustment of the different threshold voltages U_{schw1}, U_{schw2} and optionally

further components can be integrated in the micro computer μC, so that only an external capacitor C is required as an additional component for the construction of the circuitry. Different threshold voltages can also be formed by different capacitors.

The described construction therefore allows for a reliable elimination of foreign light influences in a simple manner.

CLAIMS

1. A device for operating a windscreen wiper with an automatic wiper control, which comprises a rain sensor with a transmitter radiating light, a receiver which responds to the radiated light and transmits a sensor signal, and an evaluating device for the sensor signal comprising a micro computer, characterised in that the evaluating device comprises at least one capacitor (C), which is provided outside the micro computer (μC) and to which the sensor signal (ss) is supplied, a comparator (K) is connected to the capacitor (C) and compares the voltage (u) produced in the capacitor (C) by the sensor signal (ss) with a threshold voltage (U_{schw}, U_{schw1}, U_{schw2}) and transmits an output signal (k) if the threshold voltage (U_{schw}, U_{schw1}, U_{schw2}) is exceeded, and the micro computer (μC) forms a measurement value from the output signal (k) corresponding to a time (t_1, t_2', t_2'') when the threshold is exceeded.

2. A device according to claim 1, characterised in that the evaluating device comprises a foreign light detecting device.

3. A device according to claim 1 or 2, characterised in that a terminal of the capacitor (C) leading to the receiver (ED) is connected to a first control element (T1), which is located in the micro computer (μC) or outside the micro computer (μC), and the capacitor (C) can be discharged by actuating the first control element (T1) once the threshold voltage (U_{schw}, U_{schw1}, U_{schw2}) is exceeded, and can be recharged again following discharge.

4. A device according to one of the preceding claims, characterised in that the transmitter (SD) can be actuated synchronously with a charging or recharging procedure of the capacitor (C) in order to transmit light and synchronously with a subsequent recharging procedure in order to interrupt the

light transmission via a further control element (T2) located in the micro computer (μC) or outside the micro computer (μC).

5. A device according to claim 3 or 4, characterised in that the first and the further control elements are constructed as switching transistors (T1, T2).

6. A device according to one of the preceding claims, characterised in that different threshold voltages (U_{schw}, U_{schw1}, U_{schw2}) can be preselected by means of the micro computer (μC).

7. A device according to claim 6, characterised in that the threshold voltages (U_{schw}, U_{schw1}, U_{schw2}) can be preselected by means of an internal or external voltage divider.

8. A device according to one of the preceding claims, characterised in that the reciprocal values of the measured times (t_1, t_2', t_2'') can be formed in the micro computer (μC) and the respective measurement values can be produced therefrom, and the proportion of useful light (NL) coming from the transmitter (SD) can be distinguished from additionally penetrating foreign light (FL).

9. A device according to one of the preceding claims, characterised in that the switch (T2) is constructed as a controllable current catcher.

10. A windscreen wiper operating device substantially as herein described with reference to the accompanying drawing.

The Patent Office

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Application No: GB 9701699.2 **Examiner:** Robin Hradsky
Claims searched: 1-10 **Date of search:** 23 April 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1A (AMP; ASA)

Int Cl (Ed.6): B60S 1/00-1/08

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2208433 A	Veglia Borletti (Fig 3)	1
X	WO91/09756 A1	L-O-F Co. (Fig 1)	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.