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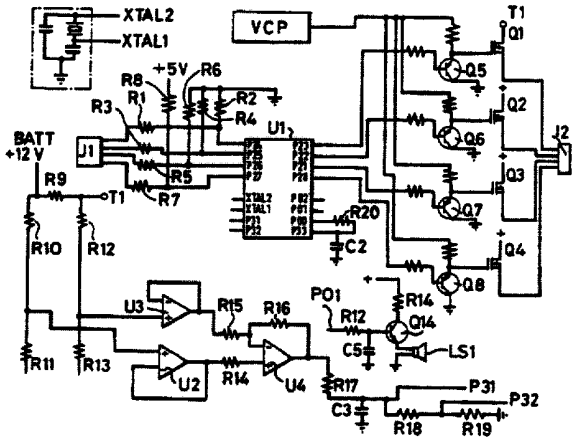
(54) Abstract Title
Direction indicator flasher unit for motor vehicles

(57) A microprocessor U1 has input ports P24, P25, P27 respectively receiving signals from left turn, right turn and hazard switches. Front left, rear left, front right and rear right direction signalling lamps are switched on and off by MOSFETs Q1, Q2, Q3 and Q4 respectively under the control of the microprocessor U1 which causes the appropriate lamps to flash according to the inputs at ports P24, P25, P27. When a plurality of the MOSFETs Q1 to Q4 is required to be on at the same time, the microprocessor U1 causes changes of state between off and on and between on and off to be staggered so that only one of the MOSFETs Q1 to Q4 changes state at a time, thus giving a more gradual change of current resulting in lower EMC emissions. The MOSFETs Q1 to Q4 are connected in series with a common current sensing resistor R9, from which is derived a balanced signal applied to input ports P31, P32 and indicative of lamp current. Each time a MOSFET switches on, the microprocessor U1 determines whether the resulting change in current indicates a lamp out or a short circuit. In the event of a short circuit, the lamp is switched off. In the event of a lamp out, the flashing rate and audible click rate from a loudspeaker LS1 are altered, or a message is displayed on a display screen. Trailer lamps may also be monitored. For situations in which the rear lamps also act as braking lamps, an input port P26 is connected to a brake switch so that when turn signalling is required during braking, the rear lamp at the selected turn side is flashed and the other rear lamp is on continuously.



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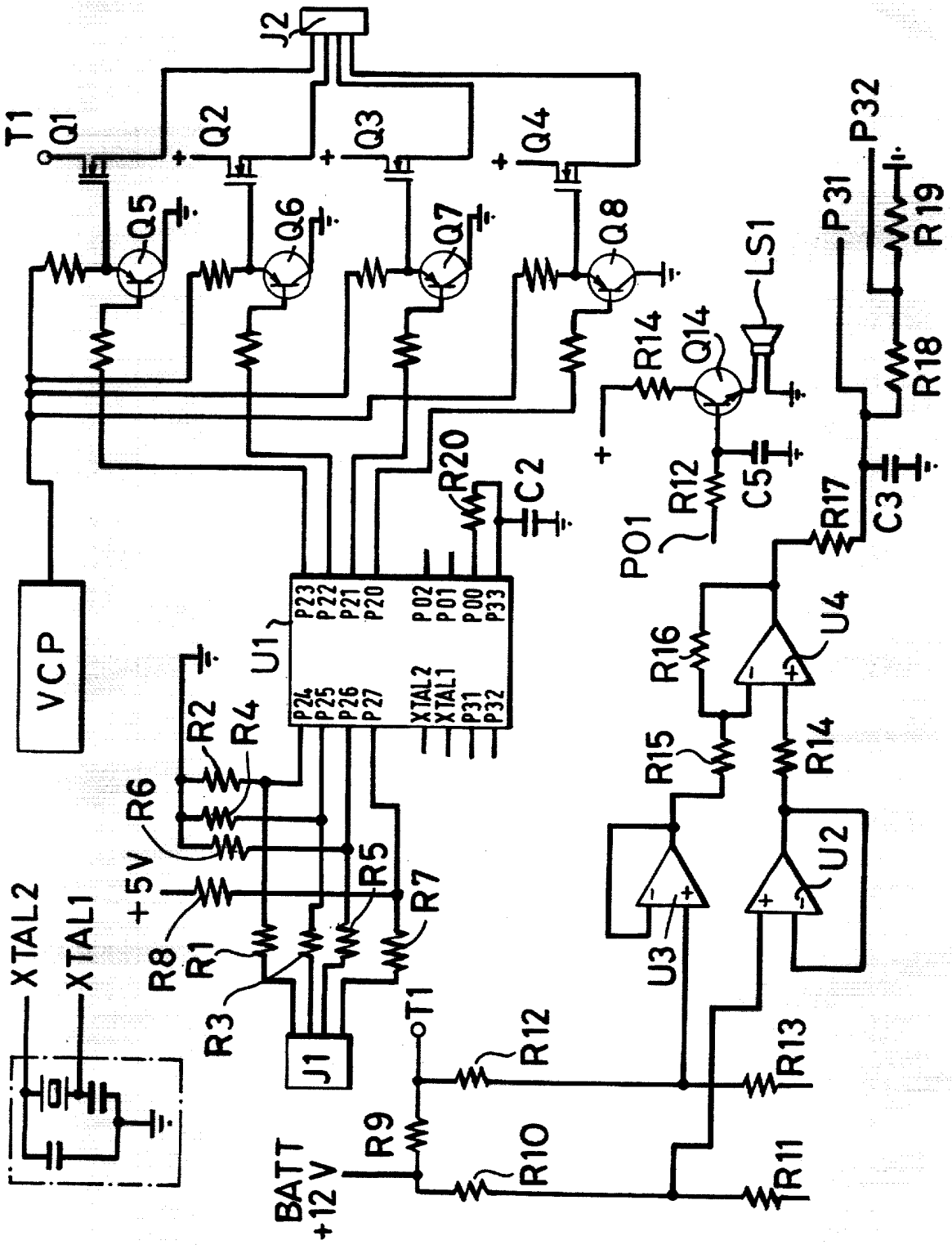
J2
T1
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
LS1
Q14
R14
R20
C2
R12
C5
R17
C3
P31
P32
R19
R18
PO1
VCP
U1
P23
P22
P21
P20
P02
P01
P00
P33
P24
P25
P26
P27
XTAL2
XTAL1
P31
P32
U4
R16
R15
R14
U2
U3
R2
R4
R6
R5
R7
+5V
R8
R1
R3
J1
T1
R12
R13
R9
R10
R11
BATT
+12V
XTAL2
XTAL1

FLASHER UNIT

This invention relates to flasher units for motor vehicles.

Turn indicators for motor vehicles are in the form of front and rear lamps on each side of the vehicle. The lamps on one side of the vehicle are flashed on and off at a regular rate to indicate that the vehicle intends to turn to that side. A conventional flasher unit opens and closes relay contacts to connect indicator lamps to battery at a regular rate. Left or right indicator lamps are selected by a turn direction indicator switch in series with the relay contacts.

In a complete break with convention, the invention provides a flasher unit for motor vehicles, comprising: a turn direction signal input port for receiving turn direction input signals for selecting left turn indication, right turn indication or no turn indication; a plurality of switching devices, at least one for one or more right indicator lamps and at least one for one or more left indicator lamps; and control means responsive to the direction input signals to drive the switching device(s) corresponding to the direction signal input on and off at a predetermined repetition rate.

In such an arrangement, the indicator switch has only to be made to carry a light signal current instead of the higher lamp operating currents of the prior art.

Conventionally, the vehicle's hazard warning switch directs the pulses of battery voltage from the flasher unit to all indicator lamps and thus also has to carry a high current. A unit in accordance with the invention preferably includes a hazard signal input port for receiving hazard input signals for selecting hazard indication or no hazard indication; the control means also being responsive to a hazard input signal selecting hazard indication to drive all the switching devices on and off at a predetermined rate.

In the USA, it is conventional for one set of lamps to serve as both brake lights and direction indicator lamps. When the brake is applied simultaneous with a turn indication, the rear lamps on the side to which a turn is indicated flash. On the other side the lamps are lit continuously. This is conventionally arranged by relatively complicated mechanical switching in the direction indicator switch which, again, has to carry relatively heavy lamp operating currents. A unit in accordance with the invention preferably includes separate switching devices for front and rear indicator lamps; and a brake signal input port for receiving brake signals selecting brake indication or no brake indication, said control means being responsive to a direction signal selecting a turn indication in the presence of a brake signal selecting a brake indication, to drive the switching device for the rear indicator on the side not selected by the direction input signal continuously on. Again the turn direction indicator switch has only to carry

a light signal current and, additionally, is simplified.

In order to reduce EMC emissions, most preferably when a plurality of switching devices are required to be on at the same time, the changes of state between off and on and between on and off are staggered so that only one switching device in the plurality changes state at a time. The changes of state may be close enough that the difference is not noticeable optically. The change of current is more gradual than in the conventional arrangement where all lamps go on and off together, resulting in lower EMC emissions.

In order to indicate to a driver that one or more of the lamp bulbs has failed, a conventional flasher unit has a current sensing resistor in series with the relay switch. The voltage drop across the resistor is detected and if it is lower than a predetermined level the rate at which the lamps flash is changed. There are normally at least two lamps in parallel being the front and rear indicator lamps. Detection of a voltage drop in the series resistor which is indicative of one lamp out, is more difficult than the position would be if only one lamp were operated at a time. Addition of trailer turn indicator lamps makes the position worse. In some vehicles, especially in the USA, there are a plurality of direction indicator lamps at, for example, the rear, which increases the problem. A flasher unit in accordance with the invention preferably includes a current sensing input port for receiving a current sensing input signal indicative of the current in a respective circuit

containing a plurality of indicator lamps, the control means responding to the change of current as each switching device is driven on being outside a predetermined range, to signal a fault condition.

One embodiment of the invention, given by way of example, will now be described with reference to the accompanying drawings which is a schematic circuit diagram of a flasher unit embodying the invention.

A connector J1 receives battery voltage (logical 1) or zero voltage (logical 0) on four channels connected to respective pins of a Z8 micro processor U1, pin P24 being connected to the left indicator switch, pin P25 being connected to the right indicator switch, pin P26 being connected to the brake light switch and pin P27 being connected to the hazard warning switch. The signals are attenuated and level shifted by resistor combinations R1/R2, R3/R4, R5/R6 and R7/R8.

The level shifted and attenuated signals are presented to respective pins P24 to P27 of the Z8 micro processor U1. Logical outputs of the processor U1 are provided on pins P20 to P23. Each output drives a respective MOSFET Q1 to Q4 via an PNP transistor Q5 to Q8. In order to allow the use of inexpensive MOSFETs, their gates need to be driven well beyond their source voltage. To this end a conventional voltage charge pump VCP supplies the collectors of the transistors Q5 to Q8. The MOSFETs have their source/drain circuits connected in parallel

between battery, via a common current sensing resistor R5, and a respective indicator lamp (not shown) via a connector J2. The MOSFET Q1 drives the front left indicator lamp. The MOSFET Q2 drives the rear left indicator lamp. The MOSFET Q3 drives the front right indicator lamp. The MOSFET Q4 drives the rear right indicator lamp.

The micro processor U1 is programmed so that the MOSFETs are driven to flash on and off at a predetermined frequency in a pattern selected by the input signals as shown in the following truth table.

Lead in J1				MOSFET				
1	2	3	4	Q1	Q2	Q3	Q4	
0	0	0	0	off	off	off	off	
1	0	0	0	flash	flash	off	off	
0	1	0	0	off	off	flash	flash	
0	0	1	0	off	cont	off	cont	┐
1	0	1	0	flash	flash	off	cont	├ Canada &
0	1	1	0	off	flash	cont	flash	┘ USA only
-	-	-	1	flash	flash	flash	flash	

In a conventional arrangement the flasher has only one relay contact. Which indicator lamps are to flash is selected by the turn selector and the hazard warning switch. In this arrangement, the selected lamps all switch on and off at precisely the same time.

The microprocessor U1 is, however, programmed so that when a plurality of switching devices is required to be on at the same time, the changes of state between off and on and between on and off are staggered so that only one switching device in the plurality changes state at a time. The change of current is more gradual than in the

conventional arrangement where all lamps go on and off together, resulting in lower EMC emissions.

This arrangement also facilitates accurate sensing of lamp outage or short circuits. Opposite sides of the resistor R5 are connected to respective potential dividers provided by resistors R10 to R13, outputs from which are buffered by operational amplifiers U2 and U3. The output signal from amplifier U3 is subtracted from that of amplifier U2 by an operational amplifier U4 with its associated input resistors R14, R15 and feedback resistor R16. The output of the operational amplifier U4, representing the total current in the lamp circuits is filtered and converted to a balanced signal by capacitor C3 and series resistors R17, R18, R19. The balanced signal is taken from opposite ends of resistor R18 and fed to a balanced analogue input on pins P31 and P32 of the processor U1.

The microprocessor U1 cyclically provides a logical 1 output at pin P00. The output charges a capacitor C2 through a resistor R20. The analogue voltage on the capacitor C2 is fed to an analogue input on Pin P33 of the microprocessor which contains an analogue comparator (not shown). This compares the two analogue signals and when the voltage on the capacitor equals or exceeds that on the pins P31, P32 input, changes state. While the capacitor is being charged the microprocessor counts at a regular rate from the beginning of the cycle. When the comparator changes state,

the count is a digital representation of the analogue signal and thus the total current in the lamp circuits.

Each time the microprocessor switches on a lamp it subtracts the old digital representation of the total lamp current from the new digital representation. If the change is less than a first predetermined value the newly switched lamp is indicated to be out. If the change is greater than a second predetermined value (larger than the first) the lamp is indicated to be short circuit. In the latter case the lamp is switched off until the microprocessor is reset.

In order to provide an audible indication of the operation of the flasher unit, a pulse signal is provided at the output pin P01 of the microprocessor U1. A single pulse is provided at the same rate as the lamps are flashed. The signal is low pass filtered by a resistor/capacitor combination R12/C5 and amplified by a transistor/resistor combination Q14/R14 with a loudspeaker LS1 in the emitter circuit to provide an audible click at the rate at which the lamps flash.

Lamp outage can be indicated in one of several ways. One way of indicating lamp outage is to alter the flashing rate and click rate recognisably. Alternatively, a message may be displayed on a flat panel display screen.

Trailer lamps may be indicated functioning by flashing an additional monitor lamp or by providing an audio tone. Pin P01 of the microprocessor can provide a pulsed signal at audio repetition rate. Conventionally, a

tone is provided on and off at the same rate as the flashers when a turn is indicated and the trailer indicator lamp is functional.

CLAIMS

1. A flasher unit for motor vehicles, comprising: a turn direction signal input port for receiving turn direction input signals for selecting left turn indication, right turn indication or no turn indication; a plurality of switching devices, at least one for one or more right indicator lamps and at least one for one or more left indicator lamps; and control means responsive to the direction input signals to drive the switching device(s) corresponding to the direction signal input on and off at a predetermined repetition rate.

2. A flasher unit as claimed in claim 1, including a hazard signal input port for receiving hazard input signals for selecting hazard indication or no hazard indication; the control means also being responsive to a hazard input signal selecting hazard indication to drive all the switching devices on and off at a predetermined rate.

3. A flasher unit as claimed in claim 1 or claim 2, including separate switching devices for front and rear indicator lamps; and a brake signal input port for receiving brake signals selecting brake indication or no brake indication, said control means being responsive to a direction signal selecting a turn indication in the presence of a brake signal selecting a brake indication, to drive the switching device for the rear indicator on the side not selected by the direction input signal continuously on.

4. A flasher unit as claimed in any preceding

claim, in which when a plurality of switching devices is required to be on at the same time, the changes of state between off and on and between on and off are staggered so that only one switching device in the plurality changes state at a time.

5. A flasher unit as claimed in claim 4, including a current sensing input port for receiving a current sensing input signal indicative of the current in a respective circuit containing a plurality of indicator lamps, the control means responding to the change of current as each switching device is driven on being outside a predetermined range, to signal a fault condition.

The Patent Office

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Application No: GB 9720144.6 **Examiner:** M J Billing
Claims searched: 1 to 5 **Date of search:** 9 November 1998

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.P): H2H HSV1, HSV2; H2K KSA1.

Int Cl (Ed.6): B60Q 1/26, 1/34, 1/38, 11/00.

Other: ONLINE - EDOC, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2084413A	(PROOFLAND) - Fig.1; Abstract	1,2 at least
X	GB1259363	(TOKAI RIKA) - Fig.1; page 1 lines 38-42, page 2 lines 24-113	1,3 at least
X	GB1073862	(FORD) - Fig.3; page 2 line 101 to page 3 line 47	1,3 at least
X	US5157382	(WHELEN) - Fig.2; Abstract	1,2 at least
X	US4972174	(ONAN et al) - Fig.2; column 5 lines 6-64	1,2 at least
X	US4380753	(GANT) - Figs.1A,1B; Abstract	1,2 at least
X	US4037195	(RCA) - Fig.1; column 2 line 25 to column 3 line 65	1,2,3 at least

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