

Sensor less Wash Fluid Detection in Automotive Application

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ABSTRACT

The proposed paper describes the hardware and software method used for detection of wash fluid level in water tank used in automotive; thereby eliminating the need for sensor (Reed type switch mounted on washer bottle) for low wash fluid detection.

Wash motor is used for water spray on windscreen during wash and wipe operation. The proposed system makes use of hardware circuit used to drive the wash motor usually of DC (Direct current) type and a feedback circuitry to read back the current consumed by motor during particular wash operation. This hardware system is coupled with software algorithm such that during IGNITION ON instance wash motor will be turned on such as to get motor current readings to determine amount of load operated by motor which is related to wash fluid inside the washer bottle. Motor operation is optimized so as to avoid water spray causing nuisance to user.

It also eliminates the cost of the sensor, wiring harness and related signal conditioning circuitry used for sensor data processing. The proposed invention does not suffer from mundane sensor faults such as short to battery / ground, sensor open wire output, variation due to vibration and wear/tear.

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1.0. INTRODUCTION

Washer pump is generally made of motor coupled with the impeller (vane wheel).

Control within the car can be operated to squirt fluid onto the windshield, typically using an electrical pump via jets mounted either beneath the windshield or beneath the wiper blade(s). The windshield wipers are automatically turned on, cleaning dirt and debris off the windshield.

Low wash switch (reed type switch) is located inside the washer bottle which detects the low wash fluid and sends the digital signal to BCM (Body Control Module), in response BCM turn OFF the power supply to washer motor, so as to avoid the damages to washer motor.

If washer motor run at no load condition (washer fluid is empty or less than 10 %) then motor efficiency is very poor; results more motor heats up and may get damaged.

There is an indication on Instrument cluster or on display device for low wash fluid inside the washer bottle which informs user that washer fluid is to be added in washer bottle.

To provide the low wash fluid indication to customer, generally low wash switch (Reed type) sensor is implemented along with extra digital input pin inside the BCM and relative wiring harness.

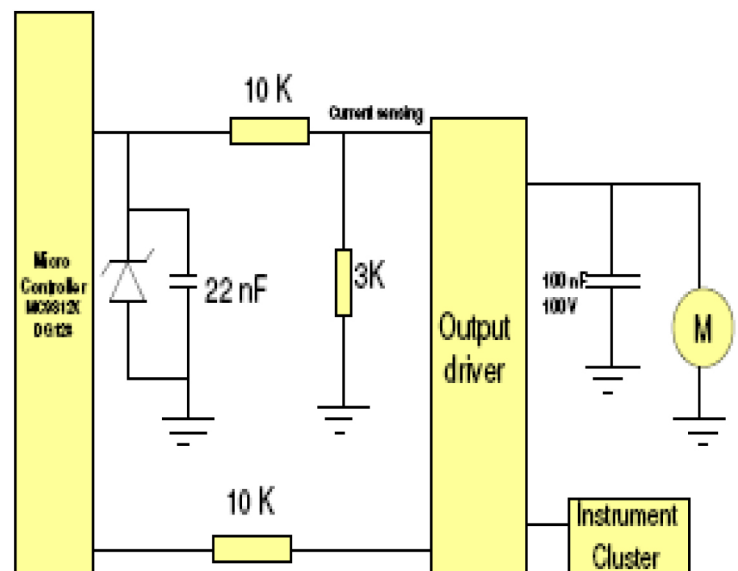


Figure 1. Body control module internal schematic to sense the washer motor current feedback

In this paper we will define methodology to detect the washer fluid by sensing the washer motor current & eliminating low wash fluid sensor.

Washer pump is used to take the washer fluid from the washer bottle which acts as a load on the motor. If washer fluid quantity inside the washer bottle is more then there is more load on the motor which consequently results in drawing more current from the battery.

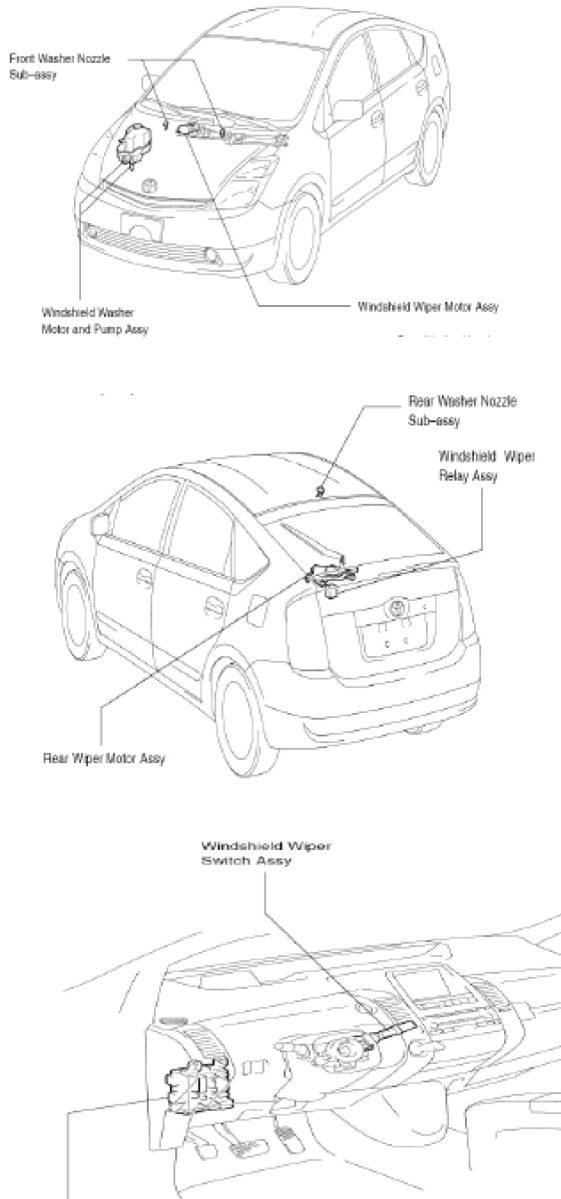


Figure 2. Washer and wiper component placement

2.0. WASHER MOTOR CURRENT MEASUREMNT AT DIFFERNET LOAD CONDITIONS

Below data shows the washer pump currents taken at different washer fluid levels inside the washer bottle.

- **Full load condition** - Washer bottle is completely filled with washer fluid.

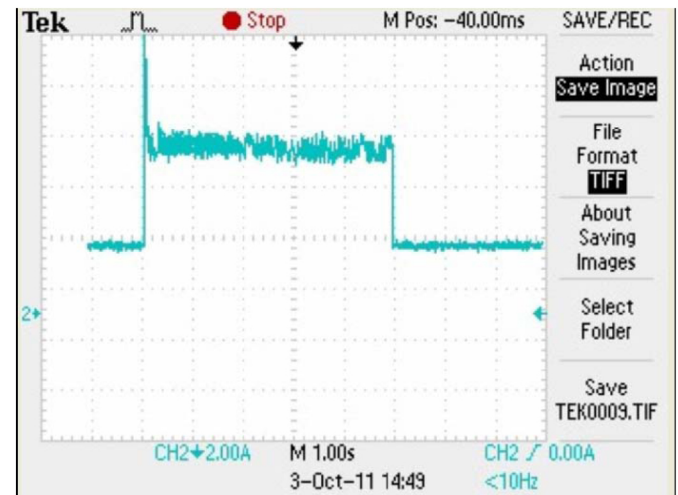


Figure 3. Full Load Condition Washer Motor operating current - 4.5 Amps @ 12 Volts

- **Half Load Condition** - Washer bottle is half filled with the washer fluid.



Figure 4. Half Load Condition Washer Motor Operating Current - 2.8 Amps @ 12 Volts

- **No load condition** - Washer bottle is empty or washer fluid is less than 10 %.

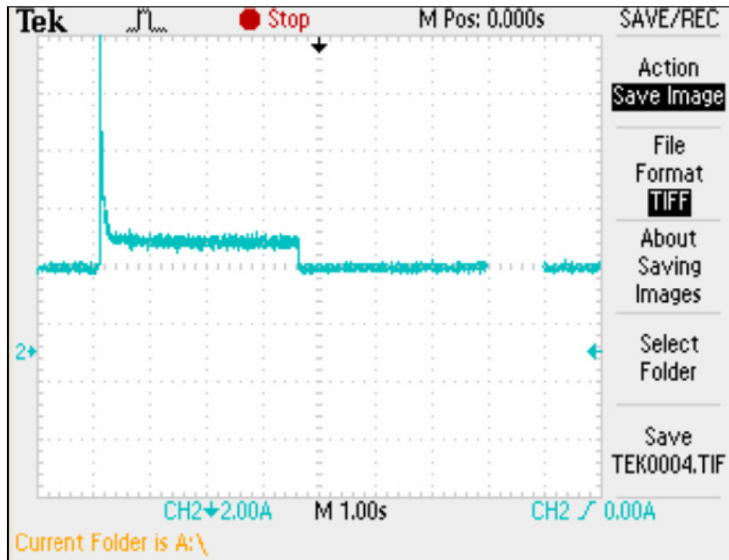


Figure 5. No Load Condition Washer Motor Operating Current - 1.0 Amp @ 12 Volts

TIME REQUIRED FOR SENSING THE WASHER MOTOR CURRENT

Below data has shows the initial washer motor inrush current i.e. the current drawn by washer motor when it is activated and BCM shall ignore the same to avoid the false measurement.

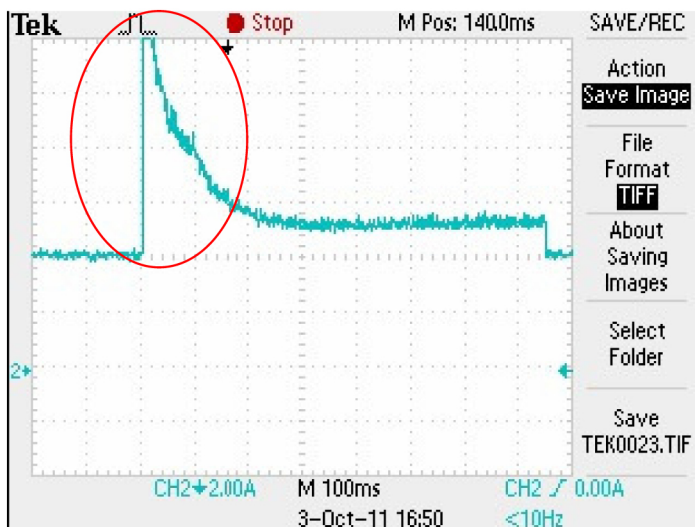


Figure 6. Typical Inrush or Starting Current

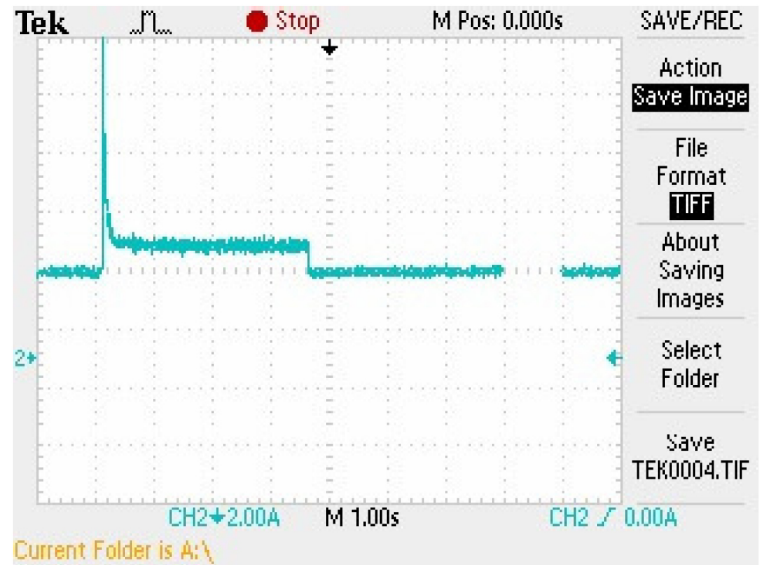


Figure 7. Typical Inrush or Starting Current

Inrush current will persists for about 250 m Seconds from the time when the washer motor is activated

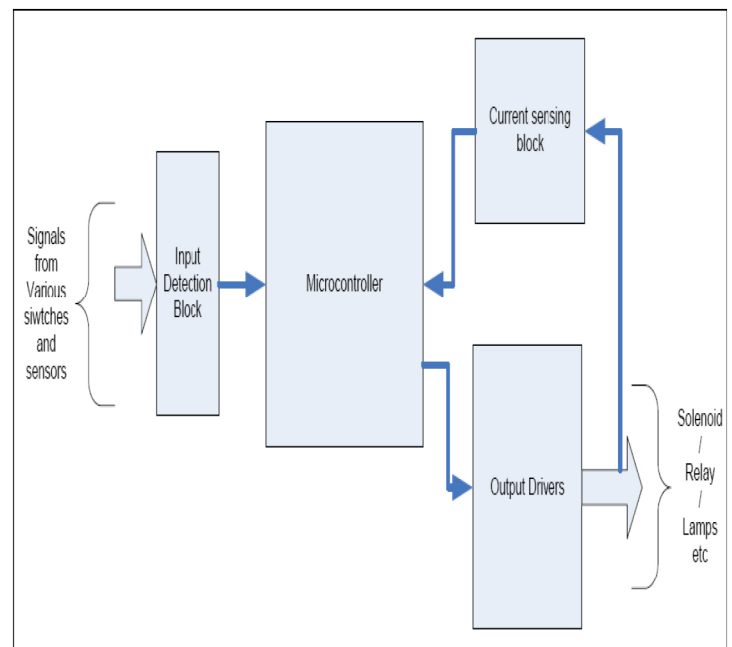


Figure 8. System Level Block Diagram