# Bus Systems

## Lab number 3
## Task number 4

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In this Lab task we are asked to, first explain the function of the circuit below and then after understanding of the function of all of the elements and whole circuit we need to test it with real modeling and show the number of wheels of the passing train in 10 seconds on a LCD device. For this reason we use Arduino as our programmable micro controller.

**Explanation of the circuit and its elements:**

5 V

4,7 KΩ

4,7 MΩ

100 Ω    1 MΩ

+ COMP

−

LM311

10 KΩ

$U_{REF}$

$U_{OUT}$

TSHA 6203    SFH203P
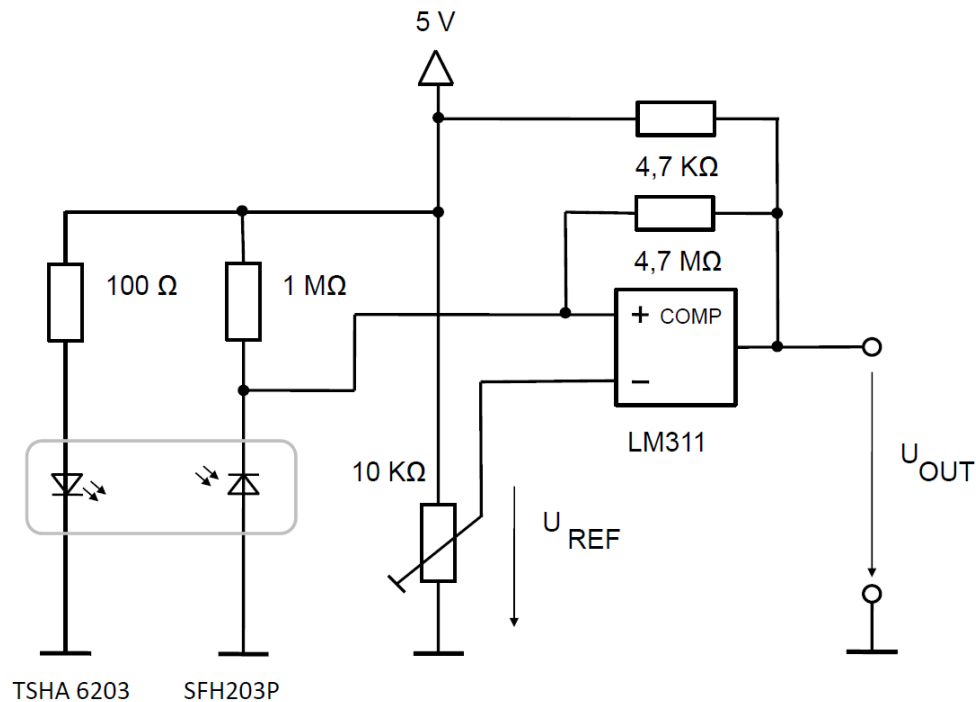
**TSHA 6203:** The TSHA620. series are infrared, 875 nm emitting diodes in GaAlAs technology, molded in a clear, untinted plastic package.

In this circuit it is used as sending light for the detector, so whenever the light is disconnected so we will understand wheel is passed.

**SFH203P:** it is used as receiver and detector for the light which is send by infrared diode (TSHA 6203).

**LM311:** The LM311 series is a monolithic, low input current voltage comparator. The device is also designed to operate from dual or single supply voltage.

**Internal block diagram of LM311:**
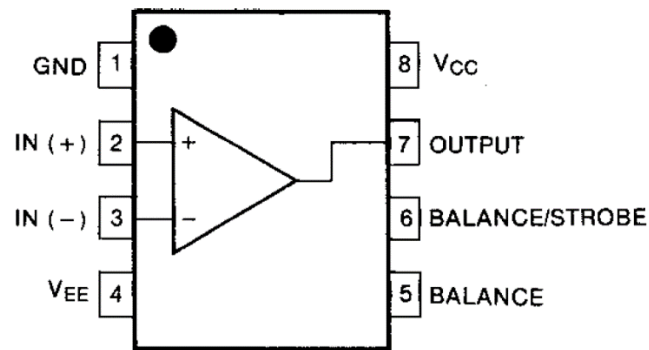


As general application of this circuit we can say it is used to detect if any wheel is passed in front of the infrared sensor or not.

**Railway circuit:** the out puts of the circuit which we talked before in shown in the picture below:



**Semaphore**: here we use semaphore to control the traffic light of the rail way. When a train is passing it will show the red light in 10 seconds and if no train passes, it will switch to green.

For doing this we need to connect to semaphore to 0 or 1 for switching between red and green.

**C Codes:**

```
#include <LiquidCrystal.h>      // initialize the library with the numbers of the interface pins

LiquidCrystal lcd(7, 6, 5, 4, 3, 2);      //port numbers which LCD is connected to

int sensorPin = A0;                  //output of the circuit is connected to this pin

int sensorValue =0 ;

int Counter = 0 ;

boolean UpEdge = false ;

boolean DownEdge = false ;

unsigned long time=0 ;

unsigned long time2=0 ;

int Light = 9 ;
```

```arduino
void setup() {               // set up the LCD's number of columns and rows:
 lcd.begin(16, 2);           // Print a message to the LCD.
 Serial.begin(9600) ;
 pinMode(Light, OUTPUT);          //output for green or red light
 digitalWrite(Light, HIGH);          //output for green or red light
}
void loop() {
   time = millis();          //get the time of the CPU
  time/=1000 ;              //change time to second
 if(((time-time2)%10==0)&&(time-time2>0))     //check if 10 second passed or not
 {
  Counter=0 ;
  digitalWrite(Light, HIGH);
 }
 sensorValue = analogRead(A0) ;          //read the output of the circuit which comes from rails
 if(sensorValue>1000)                //train in passing
 {
  time2 = millis();                    //copy and keep the live time
   time2/=1000 ;                       //change time to second
  UpEdge = true ;                      //we use this upEdge to check the change of input from 0 to 1
  DownEdge = false ;                   //we use this downEdge to check the change of input from 1 to 0
  digitalWrite(Light, LOW);           //change light to red
 }
 if(sensorValue<1000 && UpEdge)
 {                                        ///Light = HIGH ;
  UpEdge = false ;
  Counter++ ;
 }
 lcd.setCursor(0, 0);
 lcd.print(time);
 lcd.setCursor(0, 1);          // lcd.print(time2);
 lcd.print(Counter);
}
```