Wheel Slide Protection System

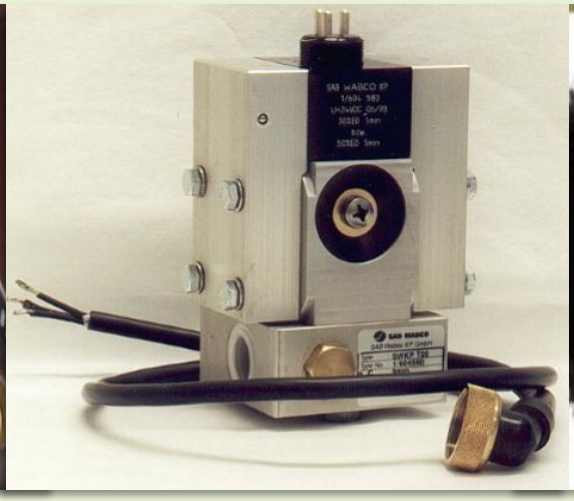
WHEEL SLIDING EFFECT

When Wheel Slides

Changes in Micro- Structure

Main components

- Microprocessor
- Speed sensor
- Dump valve
- Phonic wheel
- Pressure switch



Characteristics of WSP system

- Reduces/checks sliding of wheels on rails.
- It is activated by temporary reduction in Brake force.
- Reduces stopping distance.
- WSP system does not affect Brake power.

Difference between Slide and Skid

“Slide” as the term describes blocking of wheels during braking. It is happens when the circumferential speed of the wheels is significantly lower than the speed of the vehicle over ground.

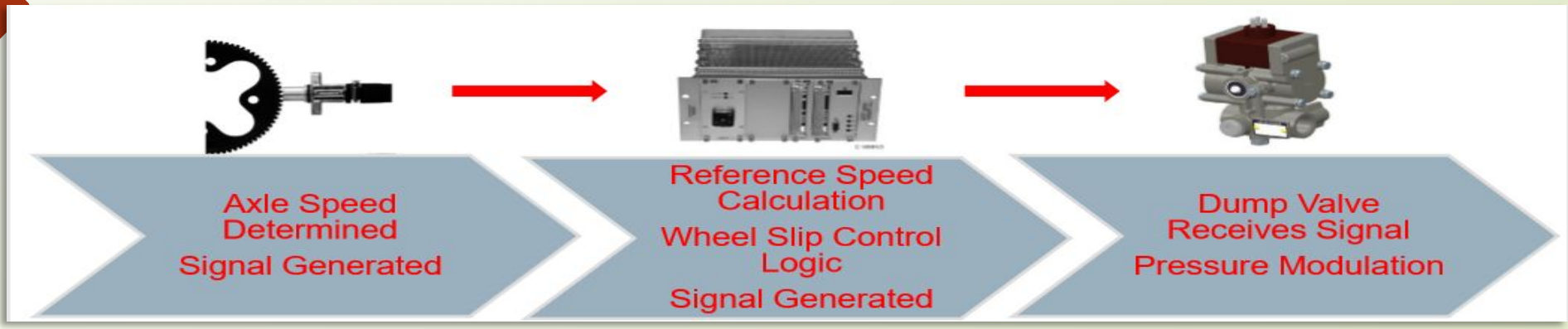
The term **“Skid”** describes the situation when the wheels rotate faster than the speed over ground which can happen during acceleration.

Working principle

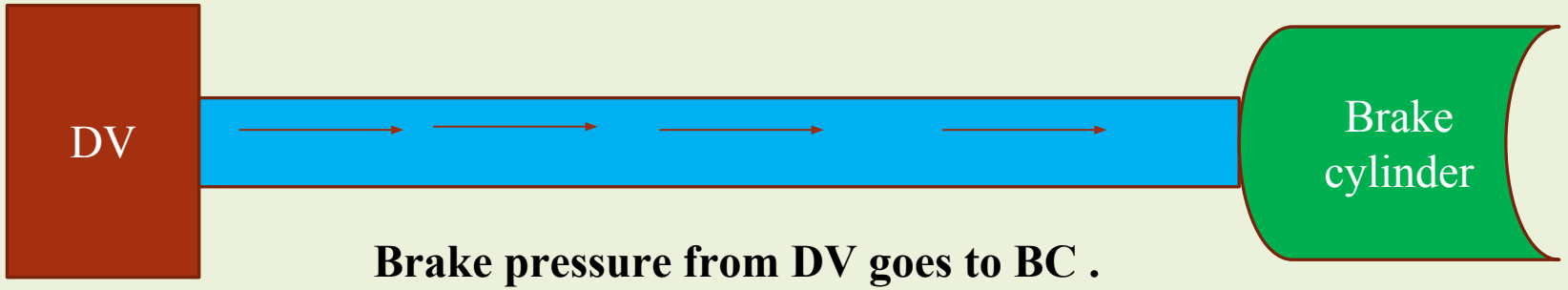
Speed sensor and phonic wheel are mounted on each axle of a coach, which send signal to microprocessor.

Microprocessor evaluates speed of different axles and generate signal to Dump valve.

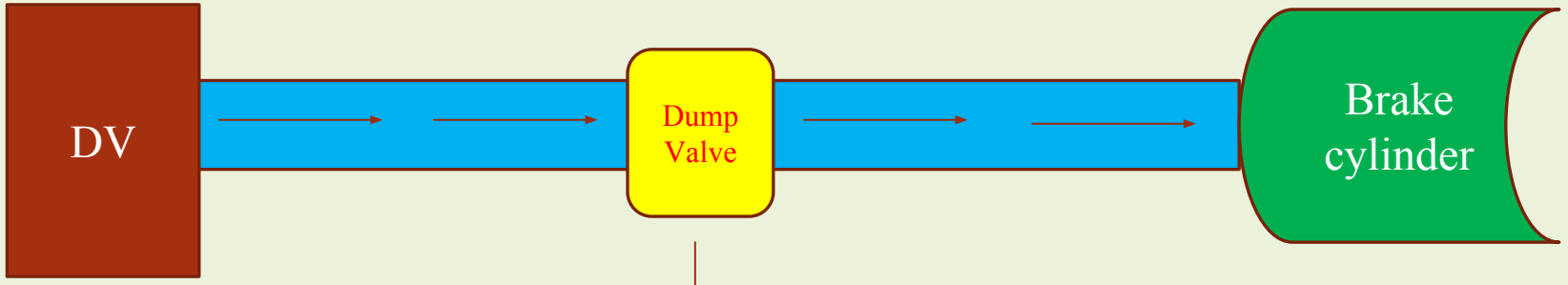
As per the signal received from microprocessor, Charging port or Exhaust port or both operates to regulate the brake cylinder pressure.



Difference between brake system with WSP and without WSP



Brake pressure from DV goes to BC .



Brake pressure from DV can be regulated With the help of Dump Valve.

Software and logics

System first of all identify the axle with highest speed at any instant.
This speed is the reference speed, **Vref**

Based on reference speed, **Vref,** two other virtual speeds are calculated-
Threshold Speed1= **Vth1**
Threshold Speed2= **Vth2**

To calculate **Vth1** and **Vth2** some formula is used in the software, the formulae used may vary between equipment manufacturers

Suppose the formulae to calculate **Vth1** is,
Vth1= Vref – (1.5 + 0.06 Vref)

and to calculate **Vth2** is,
Vth2= Vref – (2.5 + 0.25 Vref)

(Note- the formula used is only tentative and may vary from actual)

Software and logics

Logical statements are provided in the microprocessor software based on which microprocessor generates signal to dump valve to regulate brake cylinder pressure.

Logical statements are of these forms-
If, Speed of any axle= **Vi**
Threshold Speed1= **Vth1** *(upper threshold speed)*
Threshold Speed2= **Vth2** *(Lower threshold speed)*

Then, if Vi,

Vi >= Vth1 , Increase brake cylinder pressure

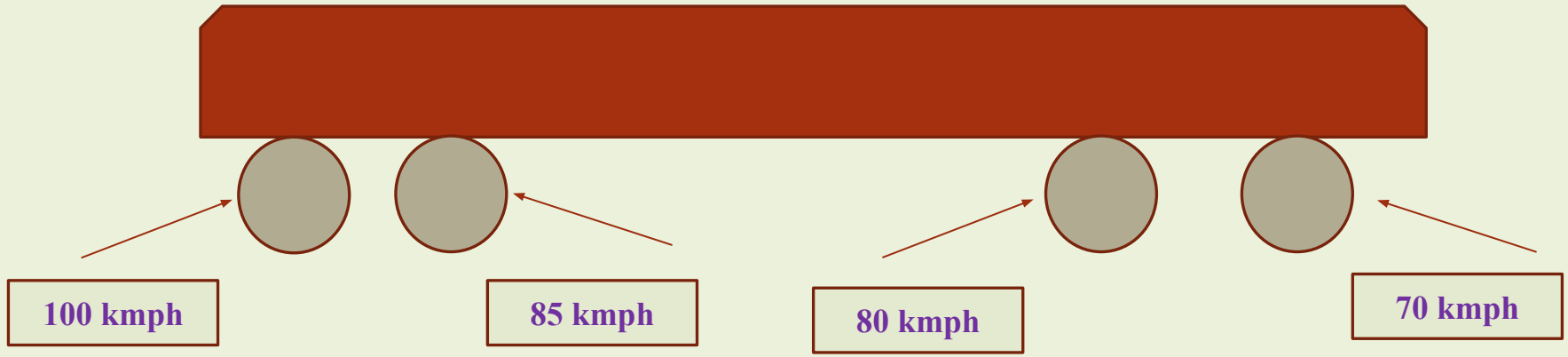
Vth2 =< Vi <= Vth1 , Hold brake cylinder pressure

Vi =< Vth2 , Decrease brake cylinder pressure

(Note- the logics used is only tentative and may vary from actual)

Let us understand with example how system works

Suppose at the time of Braking the axle speeds of different axles are as shown in the figure.



Reference speed **Vref = ?**

System calculates Vref, Vth1, Vth2

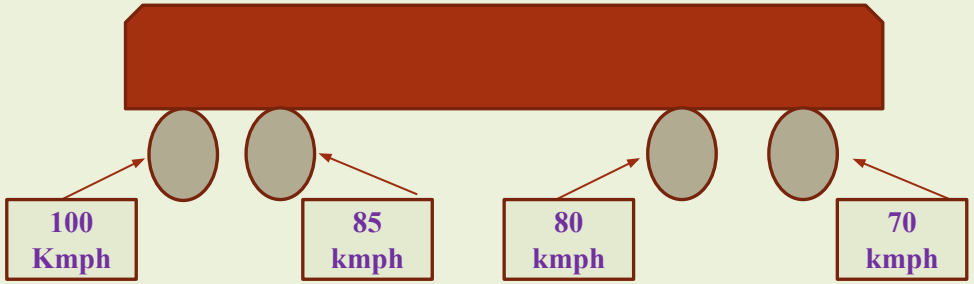
Reference speed **Vref = ?**

Vref is the axle with max speed
Therefore,
Vref = 100 kmph

Vth1= Vref – (1.5 + 0.06 Vref) &
Vth2= Vref – (2.5 + 0.25 Vref)

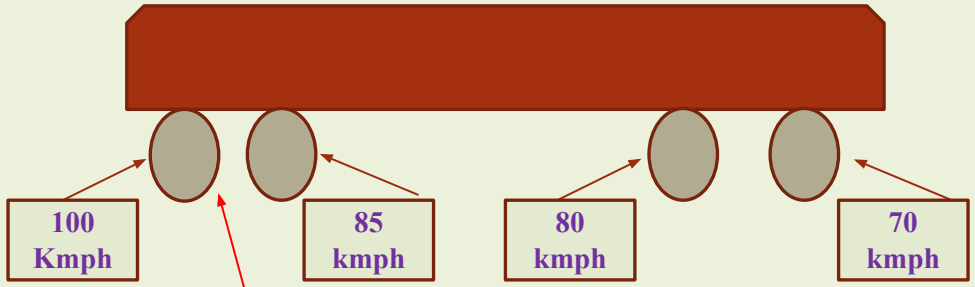
Calculate Vth1
Putting the value of Vref in formula for Vth1
Vth1 = 100 – (1.5 + 0.06 X 100) = 92.5 kmph

Calculate Vth2
Putting the value of Vref in formula for Vth2
Vth2 = 100 – (2.5 + 0.25 X 100) = 72.5 kmph



Vref= 100 kmph
Vth1= 92.5 kmph
Vth2= 72.5 kmph

Logical statements
if Vi,



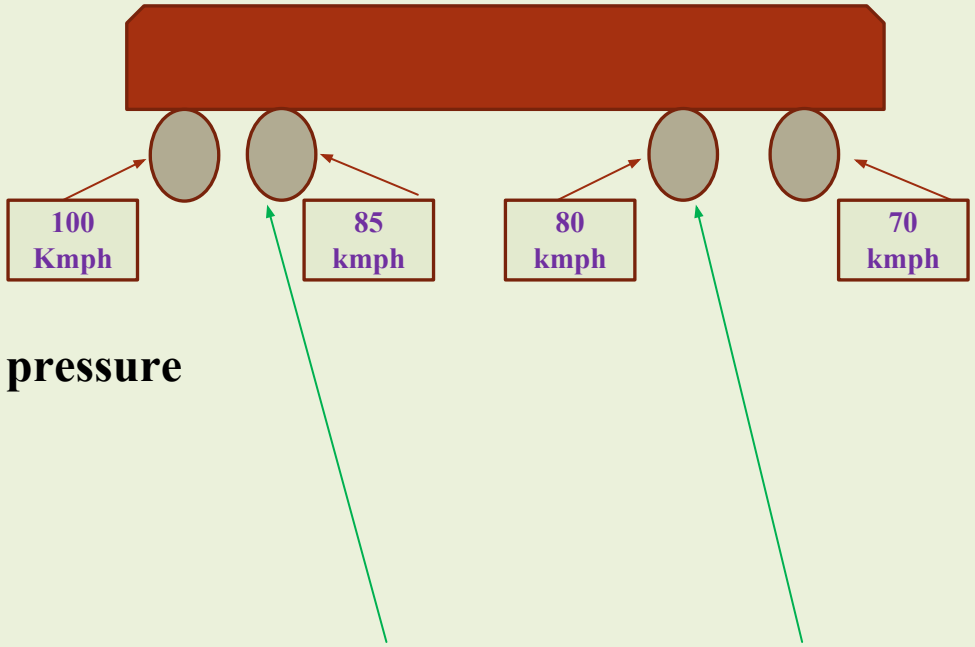
Vi >= Vth1 , Increase brake cylinder pressure

Vi= 100, 85, 80 & 70

Vth1= 92.5

System increase brake cylinder pressure on this axle

Logical statements
if Vi,

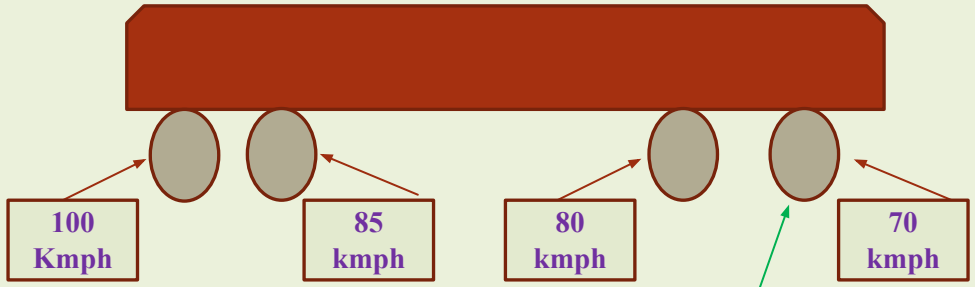


Vth2 =< Vi <= Vth1 , Hold brake cylinder pressure

Vi= 100, 85, 80 & 70

Vth1= 92.5
Vth2= 72.5

Logical statements
if Vi,



Vi =< Vth2 , **Decrease brake cylinder pressure**

Vi= 100, 85, 80 & 70

Vth1= 92.5
Vth2= 72.5

System decreases brake cylinder pressure on this axle

How system regulates brake cylinder pressure??????

Through Dump Valve

Dump valve

Dump valve is a part of WSP system, which governs brake cylinder pressure based on the signal generated from microprocessor.

Dump valve has two ports-

1. Charging port
2. Exhaust port

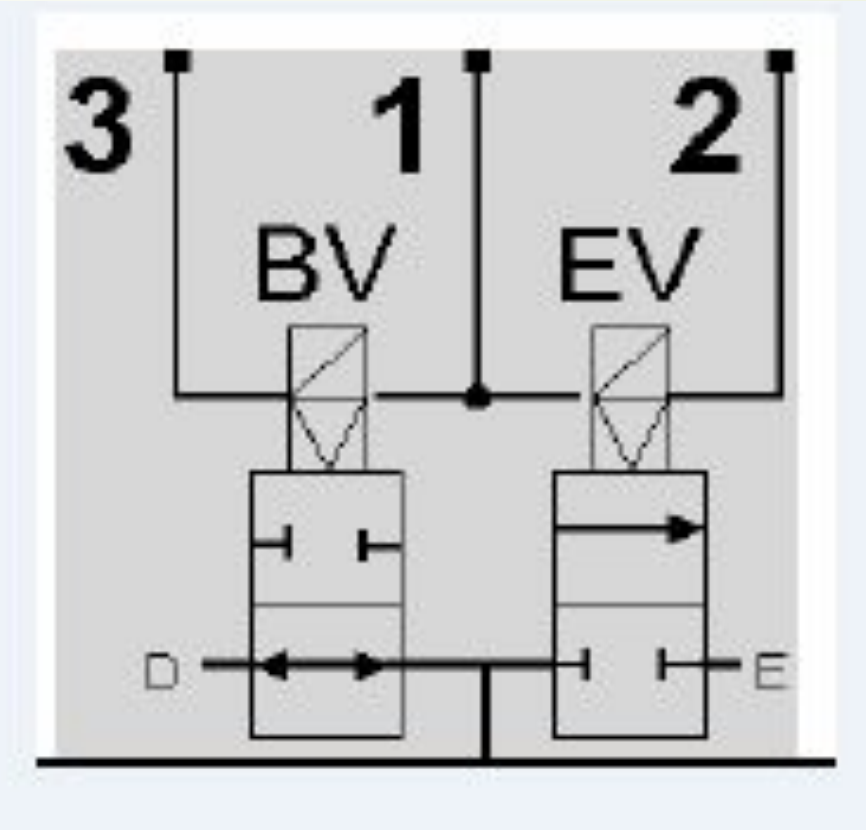
Both ports are independent.

In default position the exhaust port remains closed and charging port in open.

The ports reverse their position, the moment microprocessor generates signal.

Microprocessor generates signal in form of 24V supply to the ports.

Dump valve



24Volt supply from microprocessor

To decrease brake cylinder pressure microprocessor sends 24V signal through cables on both
"**Charging and exhaust**" ports

24Volt supply from microprocessor

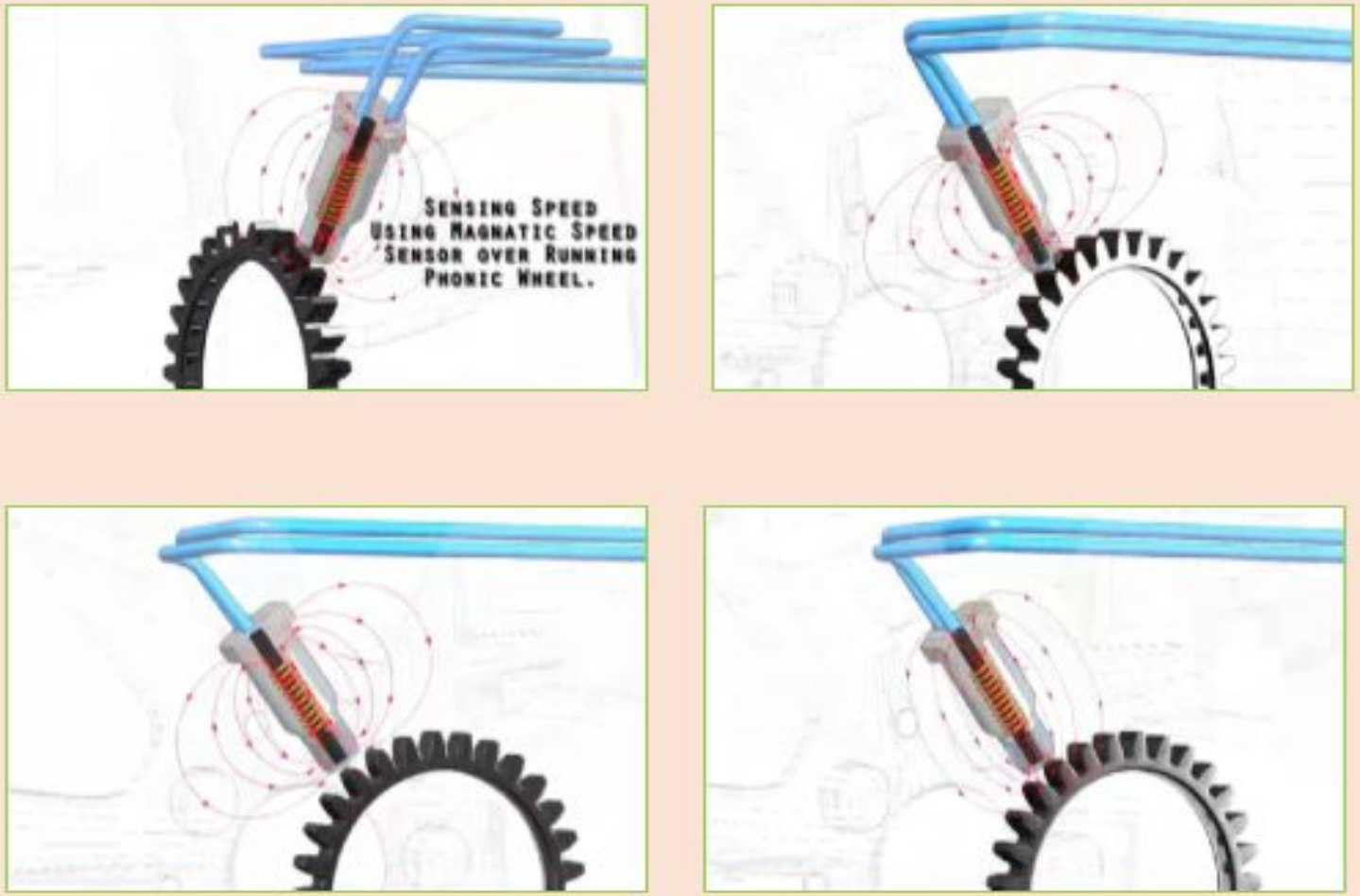
To hold brake cylinder pressure microprocessor sends 24V signal through cables on both "**Charging** " port

No supply from microprocessor

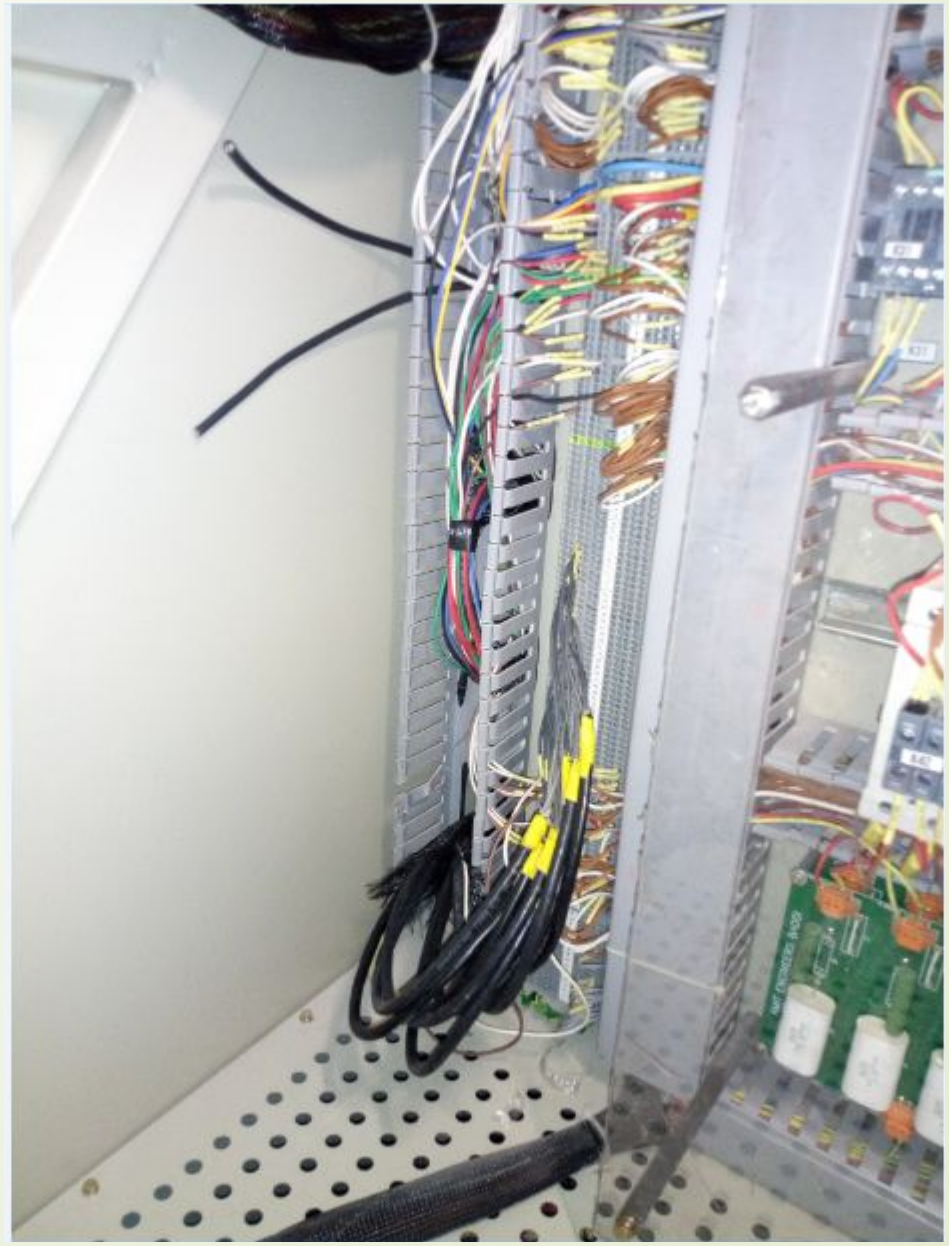
To increase brake cylinder pressure, microprocessor don’t sends any signal to the ports, as to increase brake cylinder pressure charging port needs to be open and exhaust to be closed, and this is the default position.

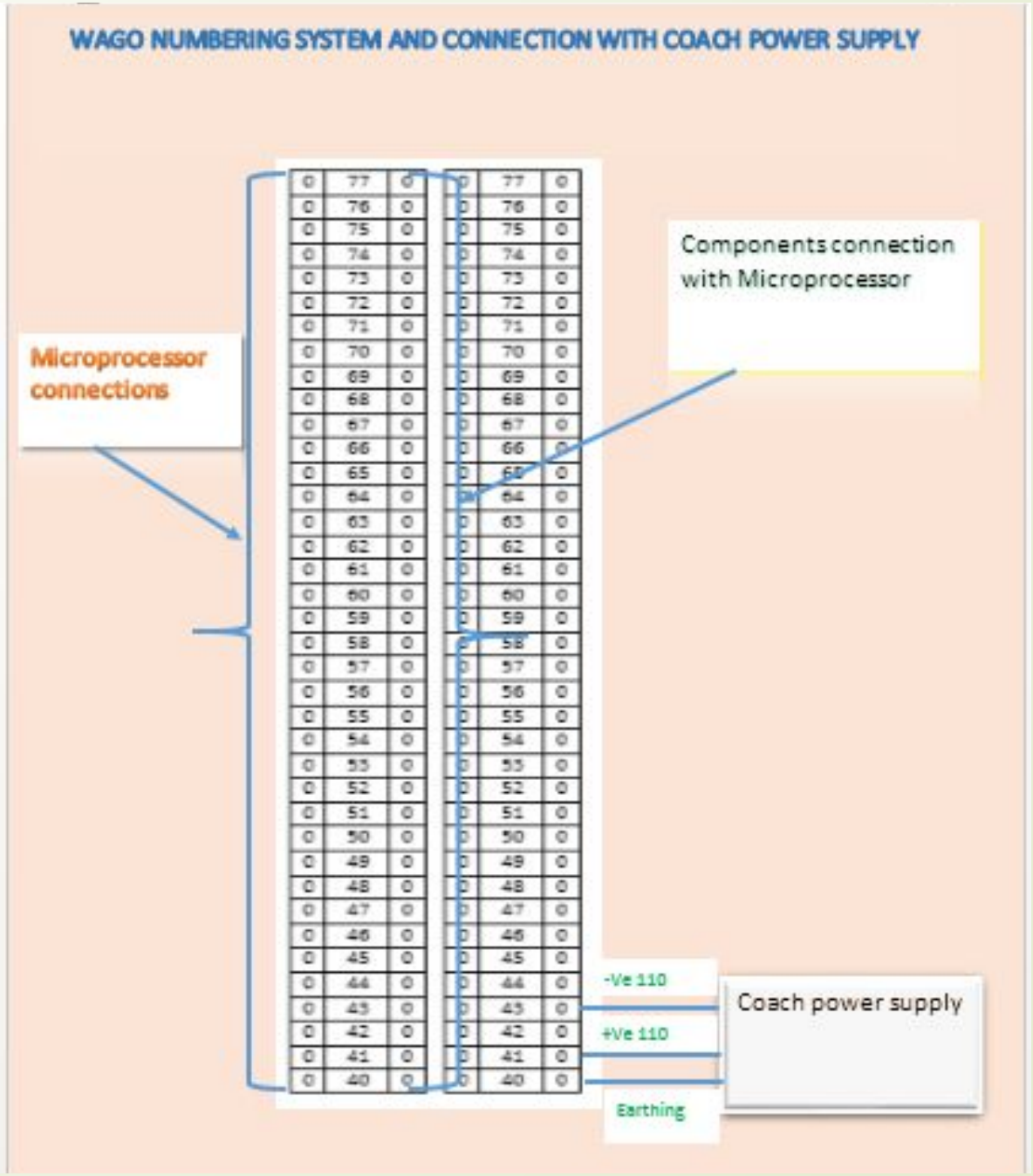
Speed sensor

The speed sensor scans a ferromagnetic rotating gear (Phonic wheel). It works without physical contact . The frequency of the digital current signal is directly proportional to the circumferential speed of the rotating gear



Pics. Showing change in internal inductance of the adjacent sensor




WAGO NUMBERING SYSTEM AND CONNECTION WITH COACH POWER SUPPLY
Microprocessor connections
Components connection with Microprocessor
-Ve 110
+Ve 110
Earthing
Coach power supply

WAGO NUMBERING SYSTEM AND CONNECTION OF MICROPROCESSOR WITH WSP COMPONENTS