



**Sensata**  
Technologies

## **Sensata's Pressure and Temperature Sensor for R744 AC applications: 'a sensor that makes sense'**

**Renske Eissens**



The World Depends on Sensors and Controls

# Content

## Part 1

- **Introduction**
- **Sensata Technologies**
- **Cabin Comfort Solutions**

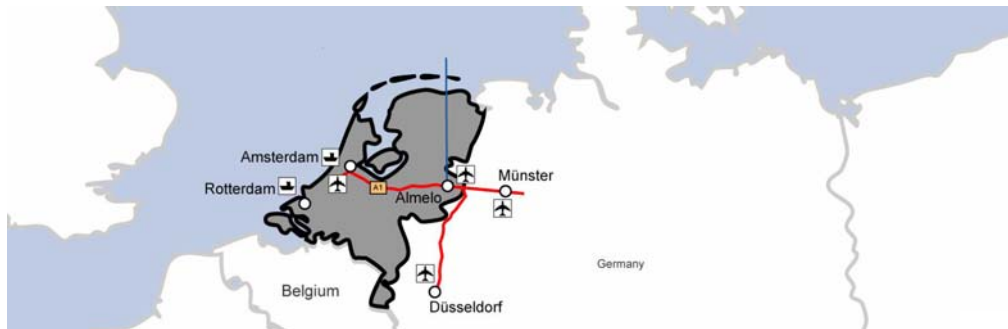
## Part 2

- **Why Sensors?**
- **R744 AC Sensor solutions**
- **Digital output compared to analog**
- **Customer choices**

## Summary

# Introduction

- Renske Eissens
- Product Manager Cabin Comfort sensor solutions
- Based in Almelo, The Netherlands



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## Sensata At A Glance

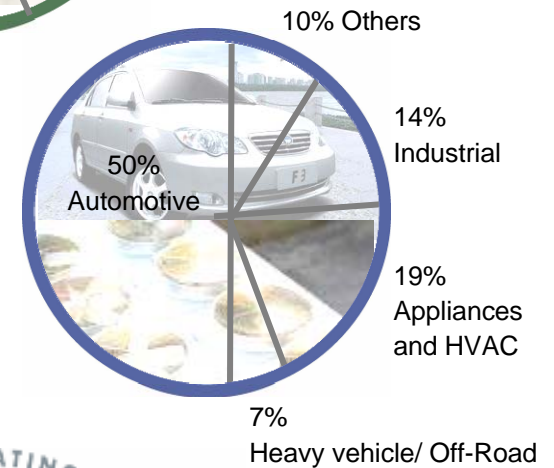
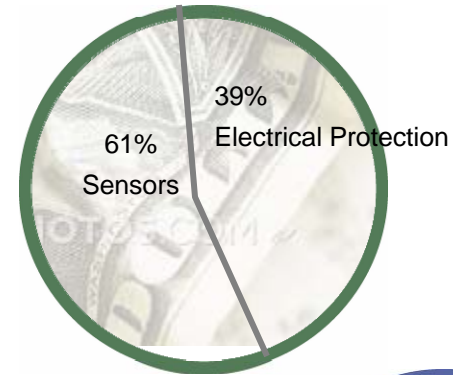


*Leading* supplier of sensors and electrical protection with revenue over \$1 billion in 2006

*Technical expertise and proven capabilities*

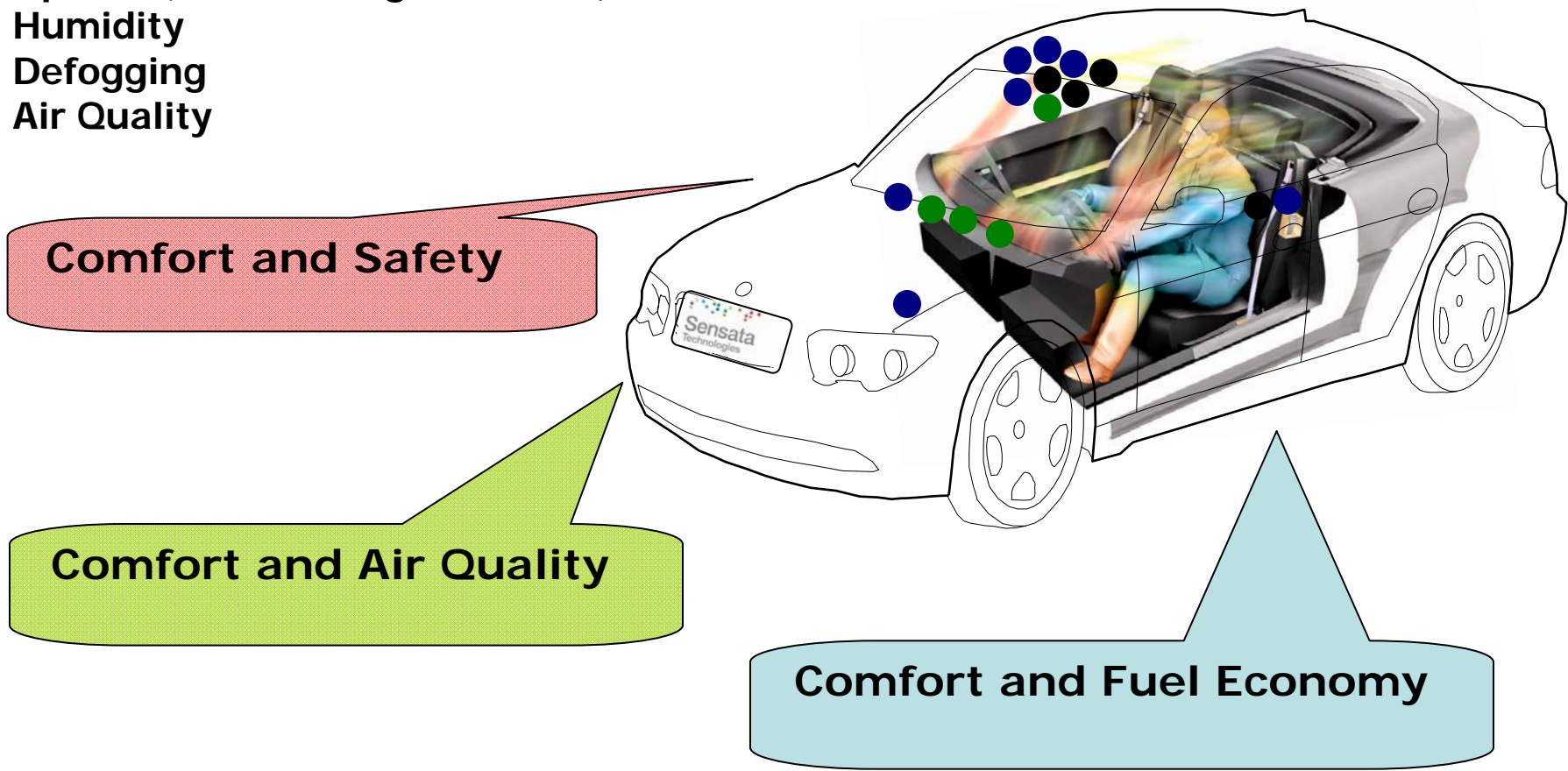
*Global presence with more than 10,000 employees*

*Cost advantage through volume scale and best cost producing sites*



# Cabin Comfort sensor solutions

Pressure sensors  
Combined pressure and temperature sensors  
Optical (Solar, Twilight, Tunnel)  
Humidity  
Defogging  
Air Quality



# Why sensors?

	R134a AC	>>	R744 AC
• <b>Needed information (Optional)</b>	Pressure Temperature)		Pressure + Temperature
• <b>Used for</b>	FAN control Over pressure protection Cooling performance		same same + temperature same COP* optimization Leakage detection/ diagnostics Heat pump control
• <b>Sensor Technology</b>	Capacitive Ceramic		Strain Gauges, hermetic design
• <b>Experience</b>	In production since 1987: sold over 150MIO! WW market leader		Technology known within Sensata; samples available <u>Already NOMINATED today!</u>

\* COP: coefficient of performance

Note: the end use of the sensor is in some cases dependent on several other component choices within an AC system, e.g. type of expansion valve)

## R744 AC Sensor solutions

- **Dual Analog**
- **LIN**
  
- **PWM**

- **Accuracy**
  - Pressure
  - Temperature
  
- **Response time**
  - Pressure
  - Temperature
  
- **Envelope**
- **Needed pins/ wires (3,4 or5)**
- **Connector type**
- **others**

LIN = digital signal; Local Interconnected Network  
PWM = digital signal, Pulse With Modulation

# Accuracy of LIN versus analog (1/4)

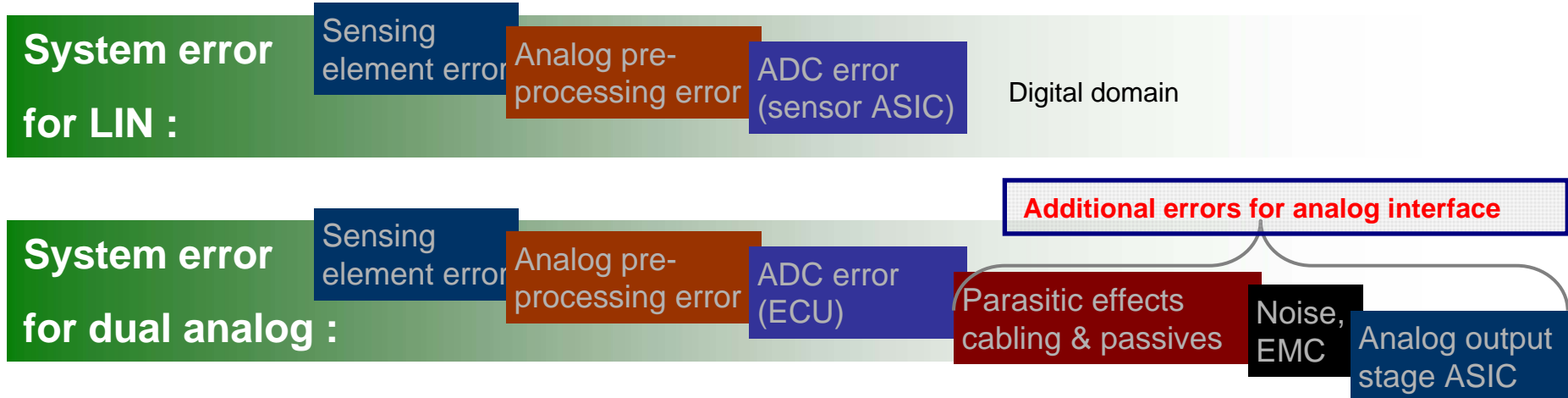
Sensata believes that on system level, a LIN approach can offer almost double the accuracy compared to a dual analog P+T sensor

The Sensata LIN solution offers:

+/-1.0...2.0 bar pressure accuracy from 0 ... 170 bar

+/-3 °C temperature accuracy @ 0 °C, 25 °C and 155 °C

Pressure and temperature response time < 7.5ms

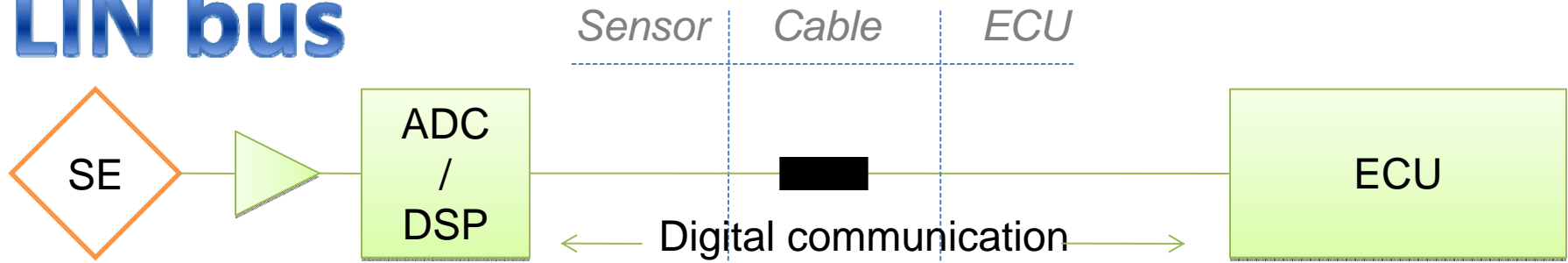


*The next 2 slides illustrate this with simplified block schematics*

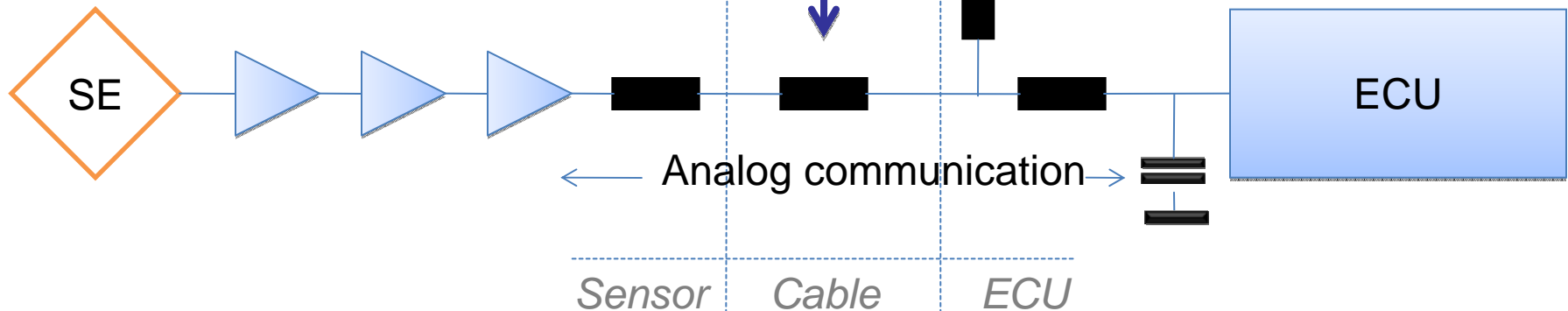


# P-Accuracy of LIN versus analog (2/4)

## LIN bus

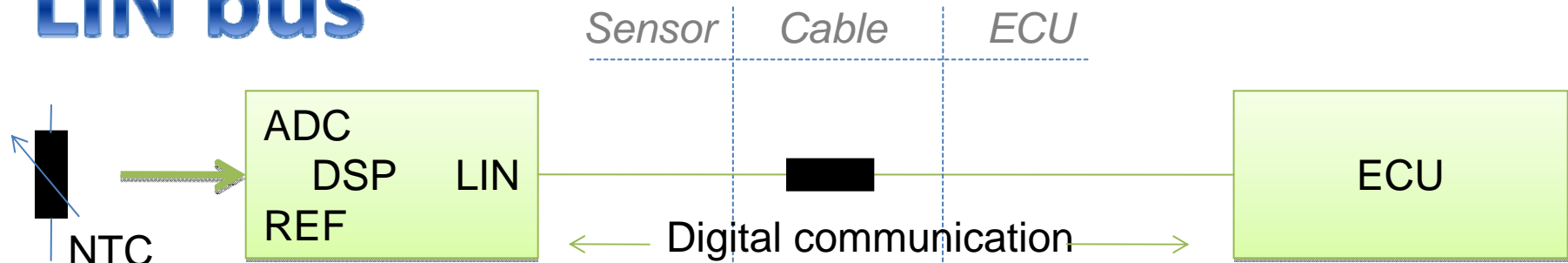


## Analog

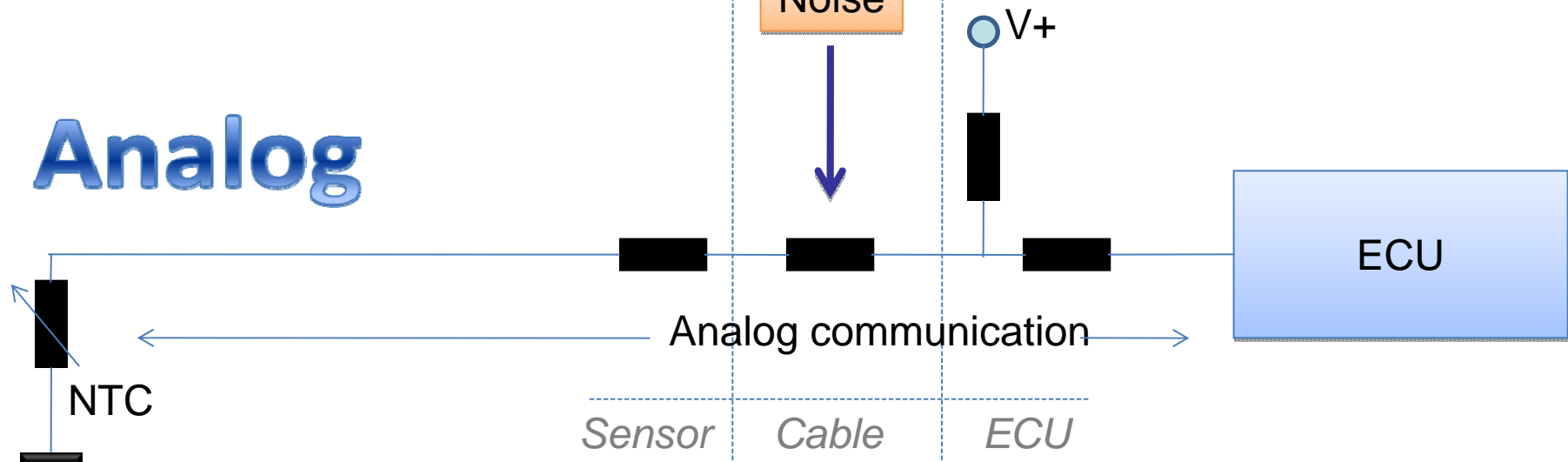


# T-Accuracy of LIN versus analog (3/4)

## LIN bus



## Analog



## Overview LIN versus Analog

- LIN offers higher accuracy over the full pressure and temperature range
- LIN has a fast response time
- Lower cost in overall system and cabling
- Less EMC sensitivity
- Additional embedded diagnostics

# Customer choices

- type of signal preferred (LIN, PWM, Analog)
- pressure accuracy
- temperature accuracy
- preferable size of the sensor
- response time
- test specifications
- total cost at system level

Sensata's engineering team leaders ready to meet demanding requirements:

<u>Electrical Engineering</u>	<u>Mechanical Engineering</u>
<p><b>Tim Tiek</b></p> <p>Title            Design Engineer Electronics</p> <p>Phone            +31 (0) 546 879470</p> <p>Mail              t-tiek@sensata.com</p>	<p><b>Werner Kleissen</b></p> <p>Title              Design Engineer R744 P+T</p> <p>Phone            +31 (0) 546 879 557</p> <p>Mail              w-kleissen@sensata.com</p>

## **‘a sensor that makes sense’**



- **enables optimized AC efficiency (cooling performance)**
- **helps maximizing the COP > improves Fuel Economy and less CO<sub>2</sub> Emission**
- **makes it possible to diagnose filling rate/ leakage detection**
- **protects components like the compressor and gas-cooler for high pressure and temperatures**
- **enables heat pump functionality**

**And, is available today!**

# Thank You

