



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**

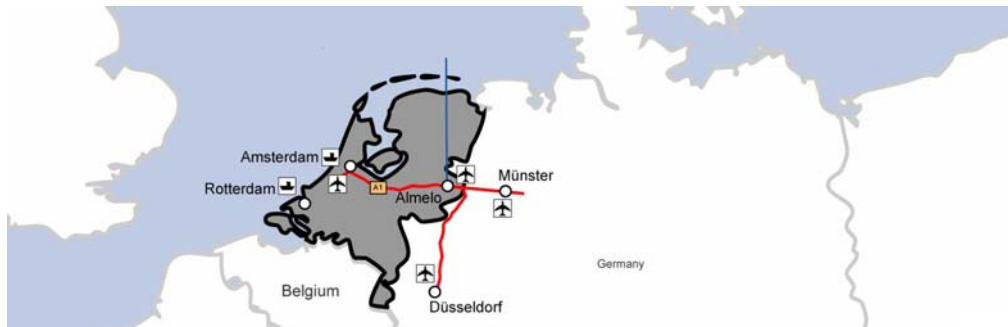
Part 2

- **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

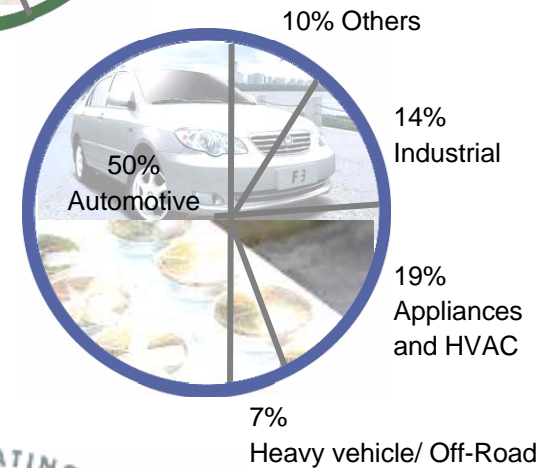
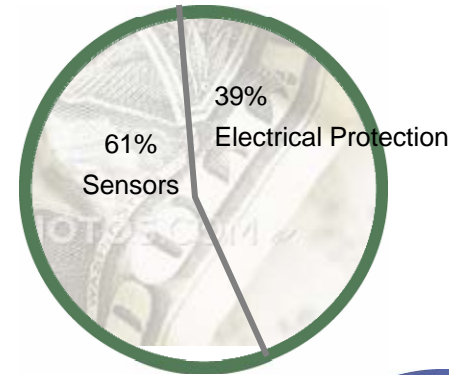


Leading supplier of sensors and electrical protection with revenue over \$1 billion in 2006

Technical expertise and proven capabilities

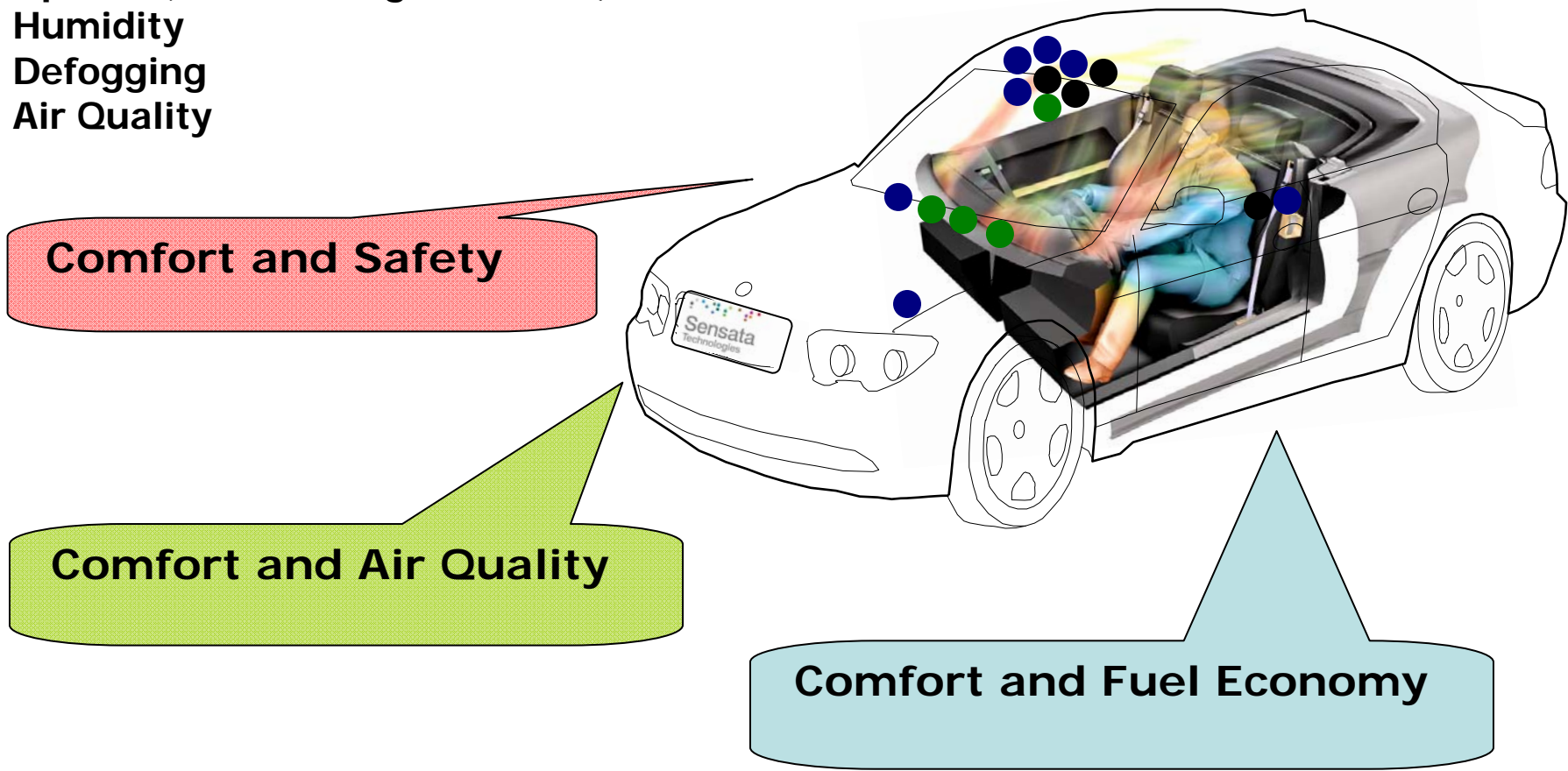
Global presence with more than 10,000 employees

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
• Needed information (Optional)	Pressure Temperature)		Pressure + Temperature
• Used for	FAN control Over pressure protection Cooling performance		same same + temperature same COP* optimization Leakage detection/ diagnostics Heat pump control
• Sensor Technology	Capacitive Ceramic		Strain Gauges, hermetic design
• Experience	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)

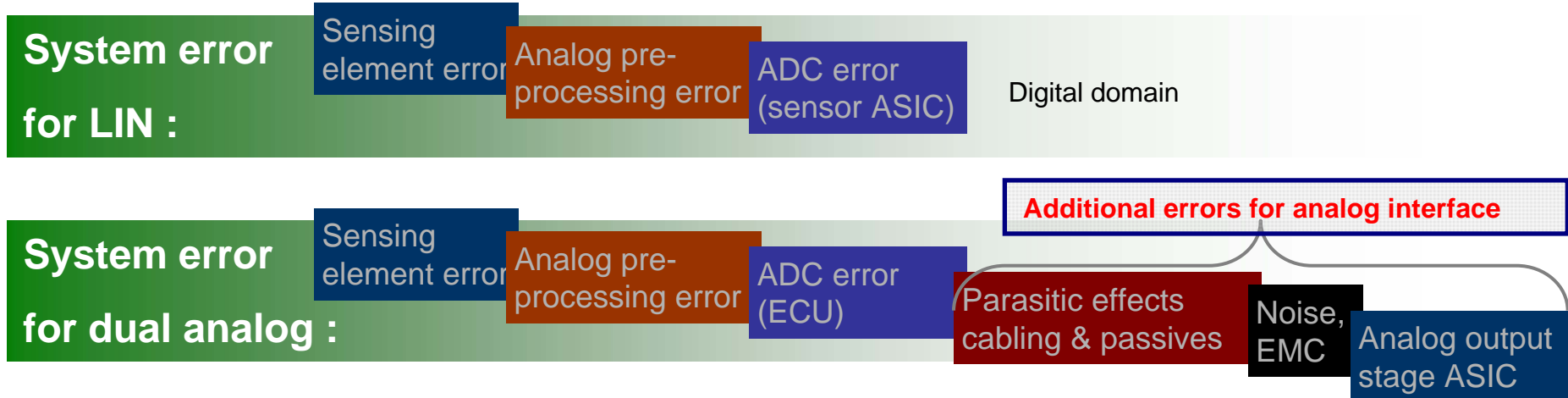
Sensata believes that on system level, a LIN approach can offer almost double the accuracy compared to a dual analog P+T sensor

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

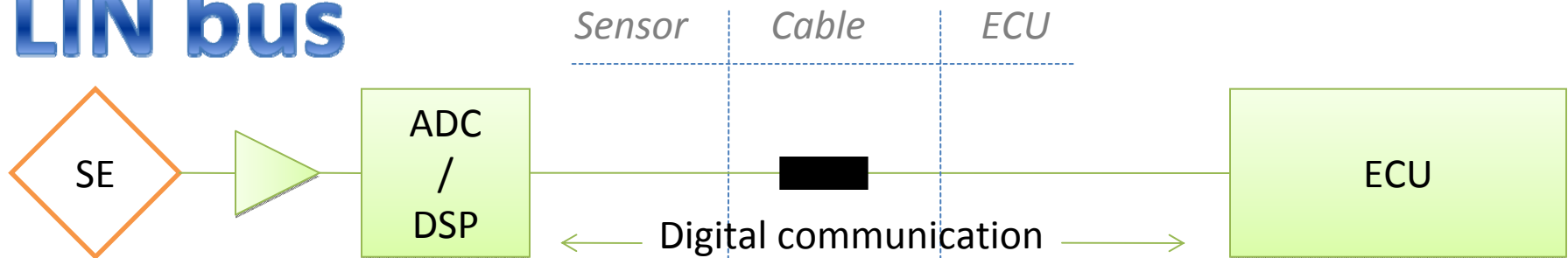
Pressure and temperature response time < 7.5ms



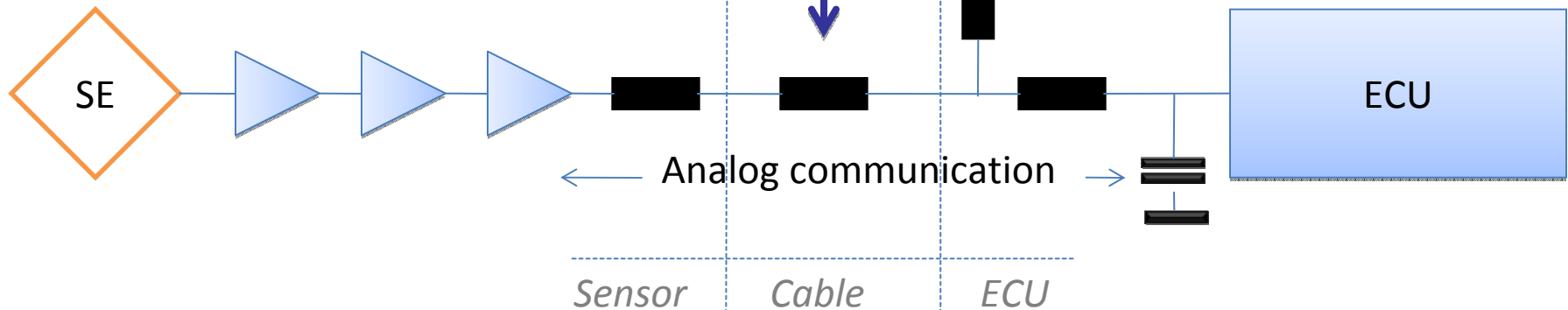
The next 2 slides illustrate this with simplified block schematics

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

LIN bus

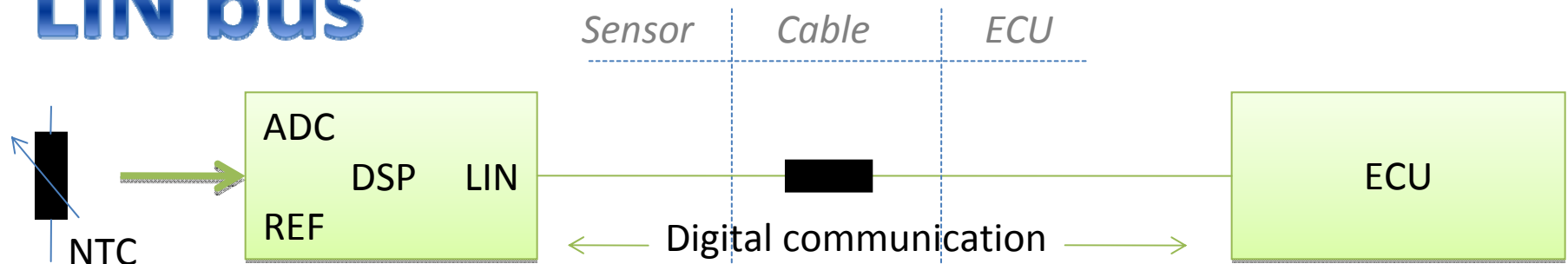


Analog

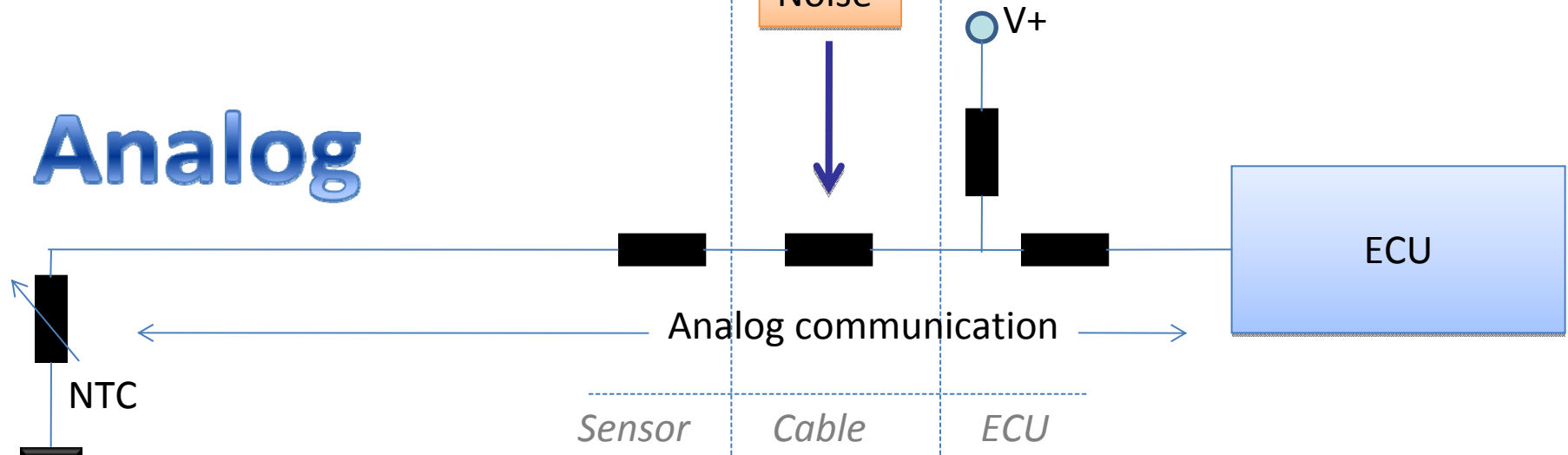


T-Accuracy of LIN versus analog (3/4)

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>
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‘a sensor that makes sense’



- **enables optimized AC efficiency (cooling performance)**
- **helps maximizing the COP > improves Fuel Economy and less CO₂ 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

