

# Mobile Equipment



## Customer Requirements

Mobile equipment is one of the most challenging outdoor application ever for a sensor. Any device installed on a vehicle is subject to extreme conditions such as:

- ✓ High level of **shocks and vibrations**
- ✓ **Very low ambient temperature** or **very high operating temperature** due to engines and exhaust systems
- ✓ Supply voltage varies from **less than 10 V to more than 48 V**
- ✓ A sudden battery disconnection from the alternator may generate a **high voltage peak** that would destroy the power supply circuit of the sensor
- ✓ Frequent high pressure and high temperature **cleaning cycles**
- ✓ **Salt** present on the road and **vehicle engine refuses gases** affect the sensor's performance
- ✓ **Electromagnetic interferences** may cause sensor's malfunctioning



concrete mixers



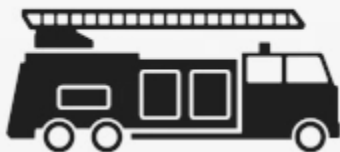
earth-moving equipment



forklifts



agriculture machines



fire trucks



garbage trucks



buses



mobile cranes

## E1-Rating

- In mobile equipment, components must meet the highest quality standards to guarantee **uptime and safe operation on board**. Applications require reliable and accurate detection from inductive sensors.
- **E1 type approval** is a rigorous government certification for mobile equipment that allows operation of a component on public roads and certifies it fully meets the extremely stringent requirements.

ECE 10R-06



## Applications

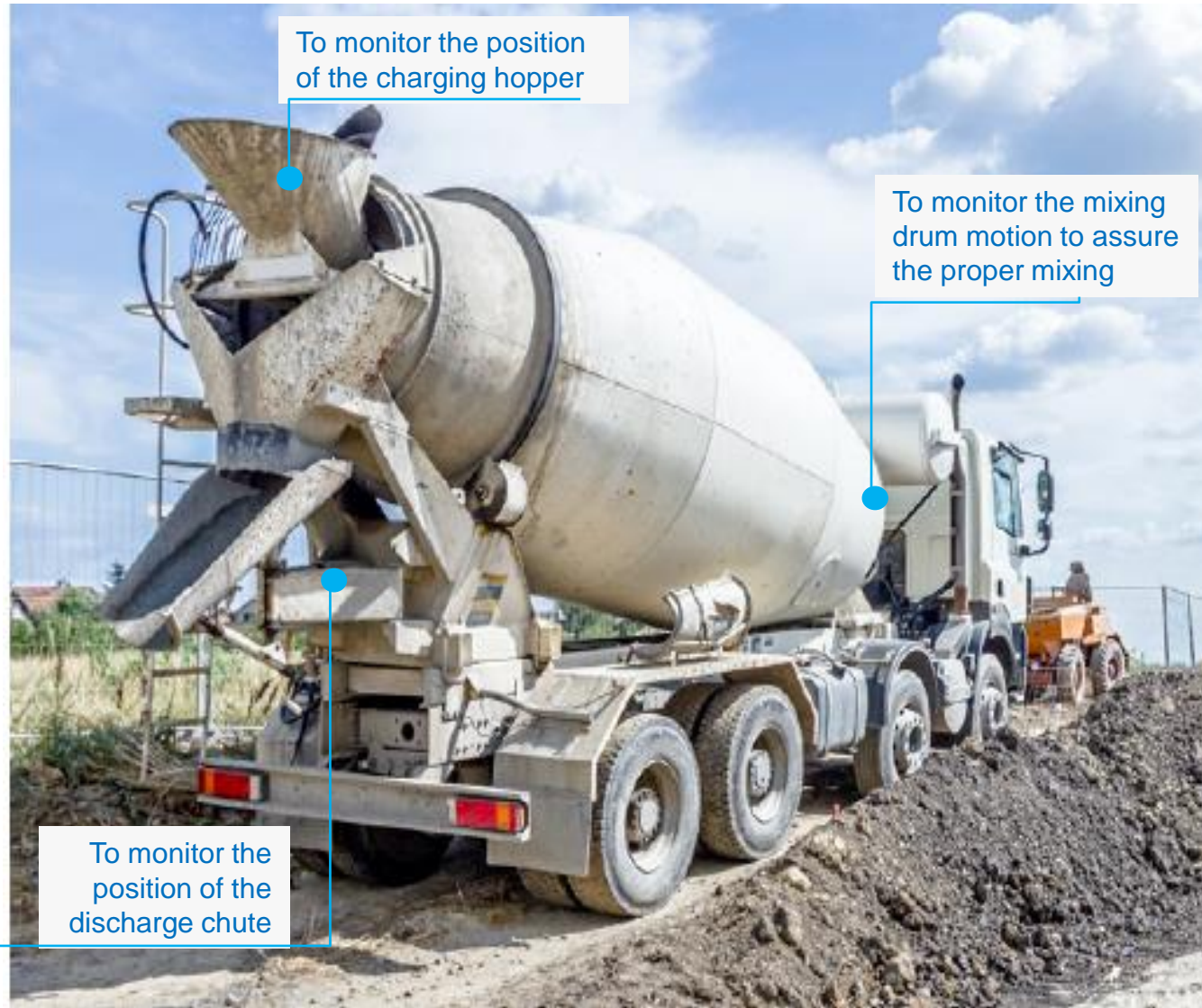




## Application Examples – Concrete Mixer Vehicle

### CUSTOMER NEED:

Professional drivers of concrete trucks know very well the importance of cleaning their concrete mixing trucks efficiently and safely, so they periodically perform **high pressure and high temperature washdown** to remove **dirt, dust, soils, grease and oils** accumulated during daily operation. During the washing cycles electronic components may stop working due to moisture and water penetration with consequent downtime of the truck



## Application Examples – Construction Equipment

### CUSTOMER NEED:

In mobile equipment, the motor and rough terrain cause **vibrations** combined with frequent **shocks** from forceful contact can be challenging for sensors to survive. In these conditions, connections can become loose and corrosion can cause battery disconnection while the AC generator is supplying charging current to the other loads. This can produce **extraordinarily large voltage transients** that would destroy exposed onboard electronics with consequent vehicle downtime.





## Application Examples – Fire Trucks

### CUSTOMER NEED:

From everyday incidents to major disasters, in the face of danger, firefighters stand on the front lines no matter the emergency. Efficient communication is critical to their various missions, and they need to do it quickly via a dedicated secure platform for public safety communications. Two-way portable radiotelephone apparatus, like other **radio transmitters**, have the potential to interfere with electronic equipments making them fail with expensive downtime or serious consequences on safety



## Application Examples – Garbage Trucks

### CUSTOMER NEED:

Refuse vehicles are required to operate even in **extreme weather** conditions – from the coldest blizzards to the hottest desert combined with heat from the motor or exhaust onboard. A typical environment includes **dirt, sand, dust, debris, oils, and salt**. These challenges would cause a typical sensor to frequently fail.

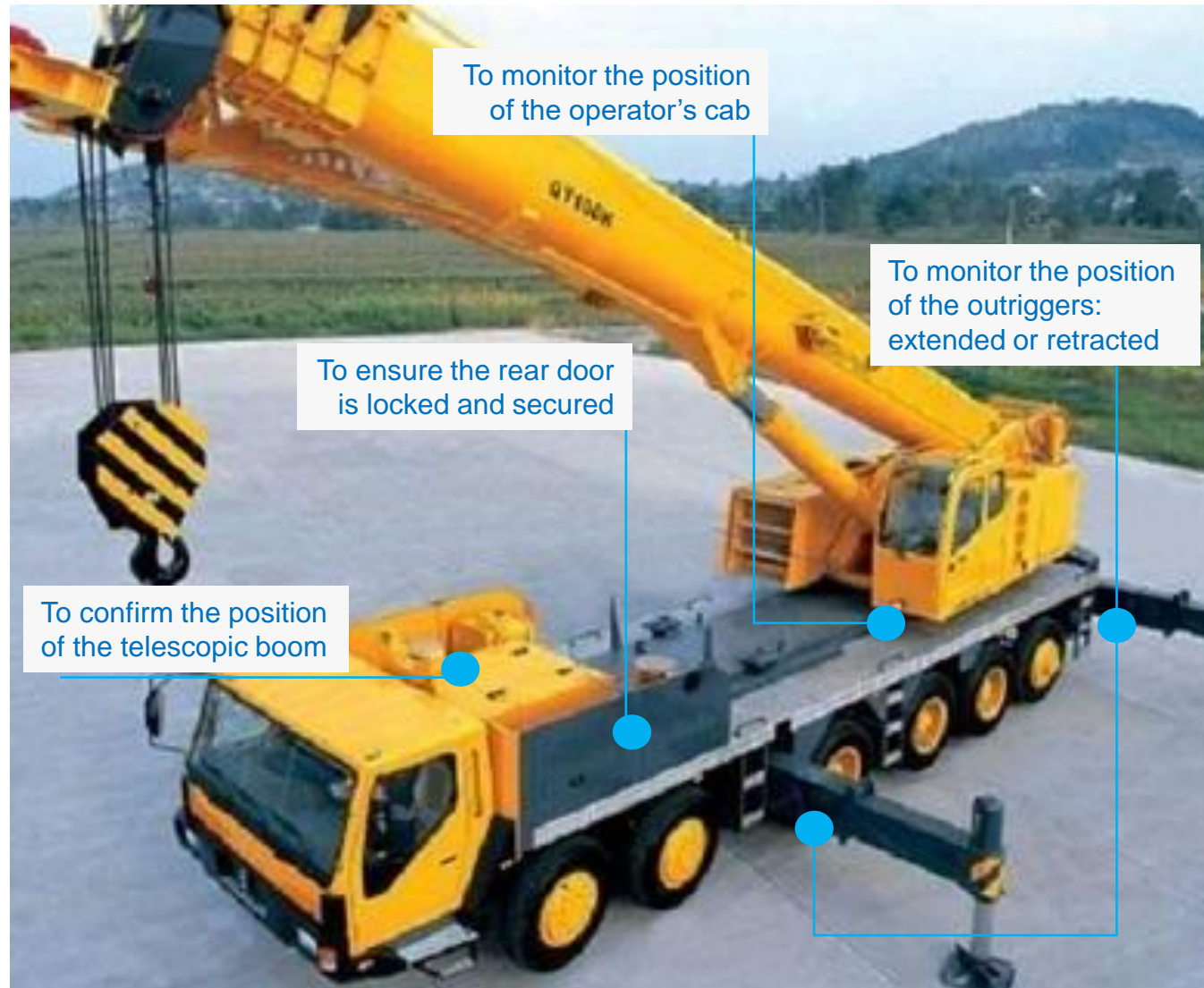




## Application Examples – Mobile Cranes

### Customer Need:

Mobile cranes, like other mobile equipments, are battery operated. For this reason, the on-board system is generally affected by very high fluctuations: from **voltage sags** when the battery is discharged, to **increased voltage** during charging, and **voltage dips** when higher electrical loads are switched on (e.g., aerial ladders or pumps)



## Customer Needs



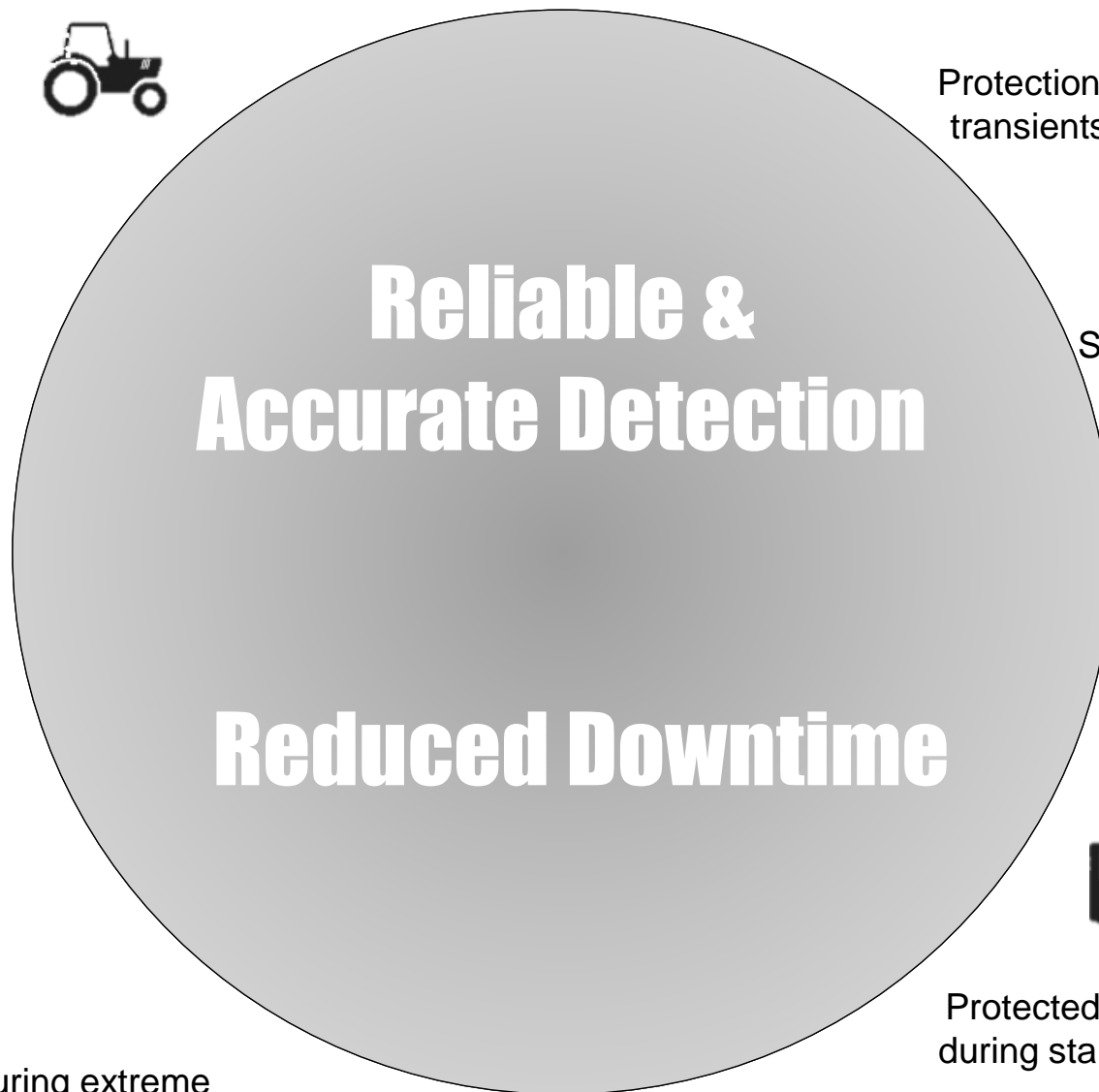
Withstands rough washdown cycles



Survives shock, vibration, and exposure to salt, oil, dust, debris



Detection even during extreme environmental conditions & exposures



Protection against large voltage transients, such as load dump



Safe and continuous operation in any battery condition



Immune to false trips from radio transmitters for efficient communication



Protected from surges & bouncing during startup and load interruption

# SENSORS for MOBILE EQUIPMENT



## ICS E1 Inductive – Unrivaled Design & Manufacturing

### ELECTRICAL PROTECTION

Protection against large voltage transients, such as load dump



Safe and continuous operation in any battery condition



Immune to false trips from radio transmitters for efficient communication



Protected from surges & bouncing during startup and load interruption

### EMC PERFORMANCE

# Reliable & Accurate Detection



# Reduced Downtime



Withstands rough washdown cycles

### MECHANICAL DURABILITY

Survives shock, vibration, and exposure to salt, oil, dust, debris



Detection even during extreme environmental conditions & exposures

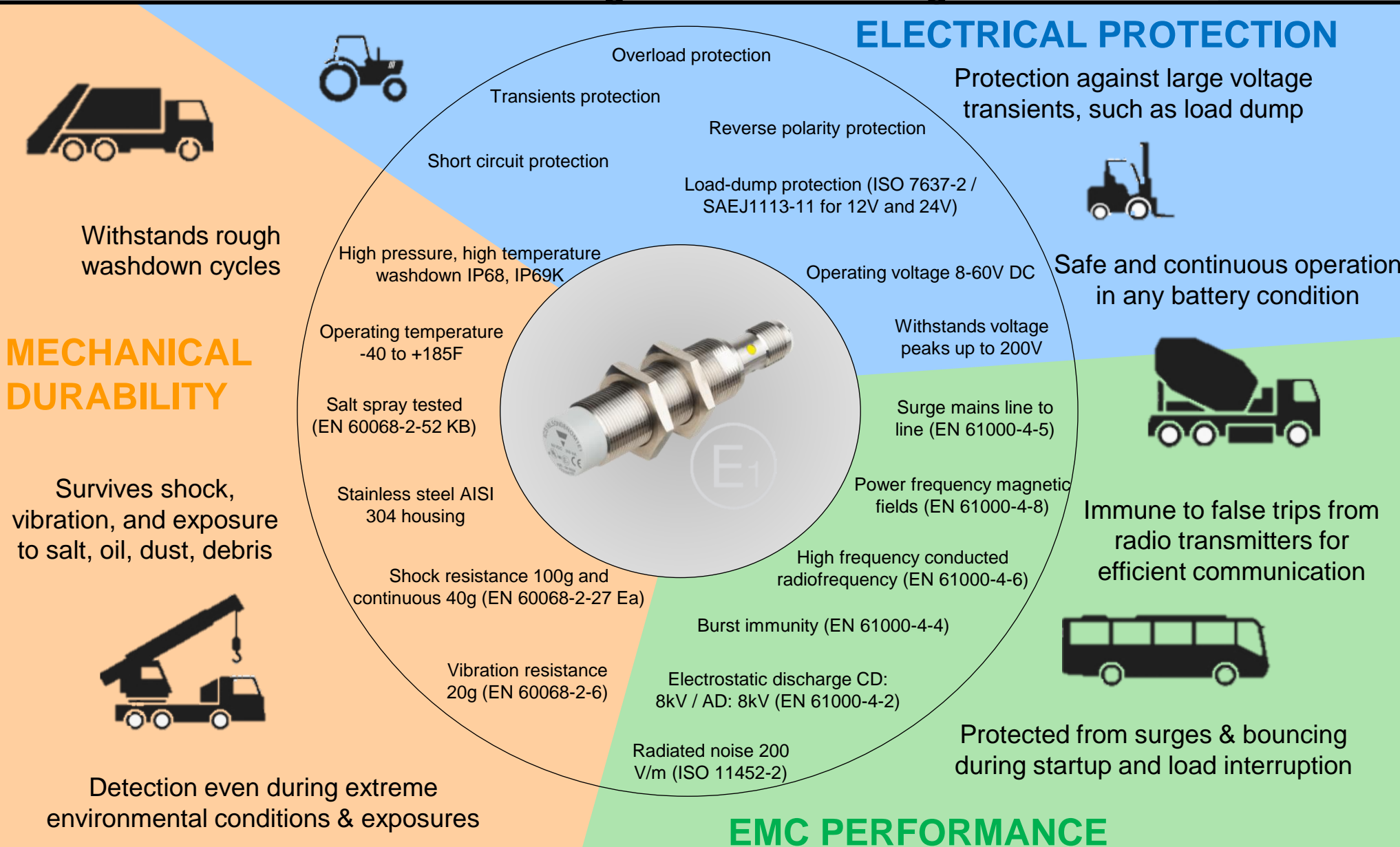




# SENSORS for MOBILE EQUIPMENT



## ICS E1 Inductive – Unrivaled Design & Manufacturing



## Additional ICS E1 Features

### Custom Connectors



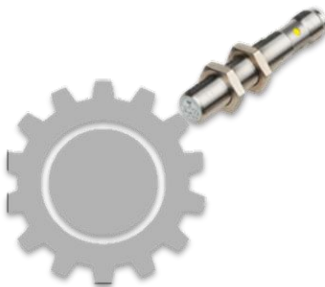
Upon request, preassembled cables and connectors (Deutsch, Packard, Molex, etc.) can be provided to meet every customers' application needs

### Traceability



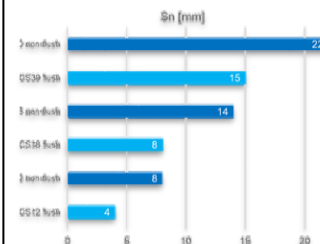
Permanently legible laser etched information on the sensor cap

### High Switching Frequency



Reliable detection of fast rotating targets

### 2x Sensing Range



2x standard sensing range allows sensors to be positioned farther away from moving targets and potential damage

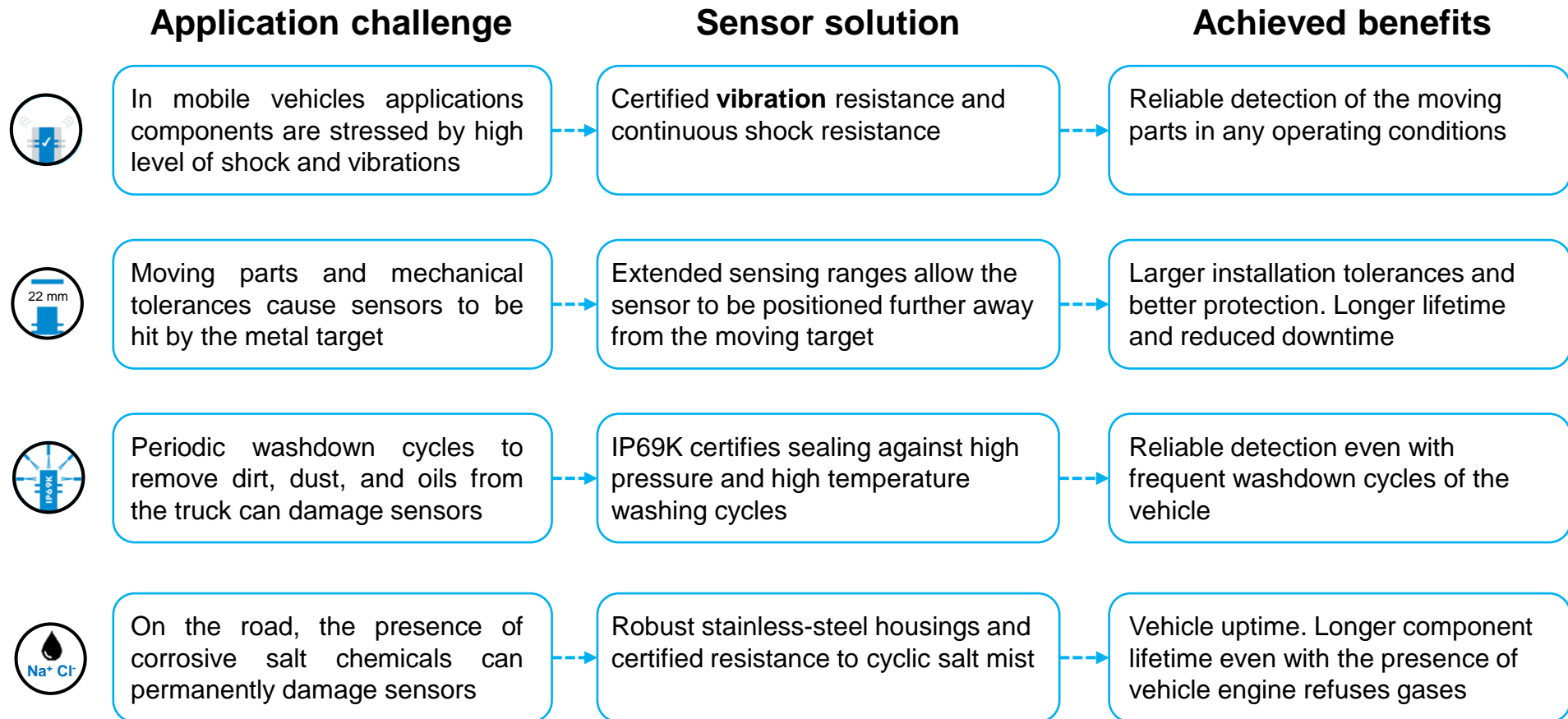
### User Interface



360 degree LED visibility to quickly understand sensor status: operational, short-circuit protection, overload protection, target detection

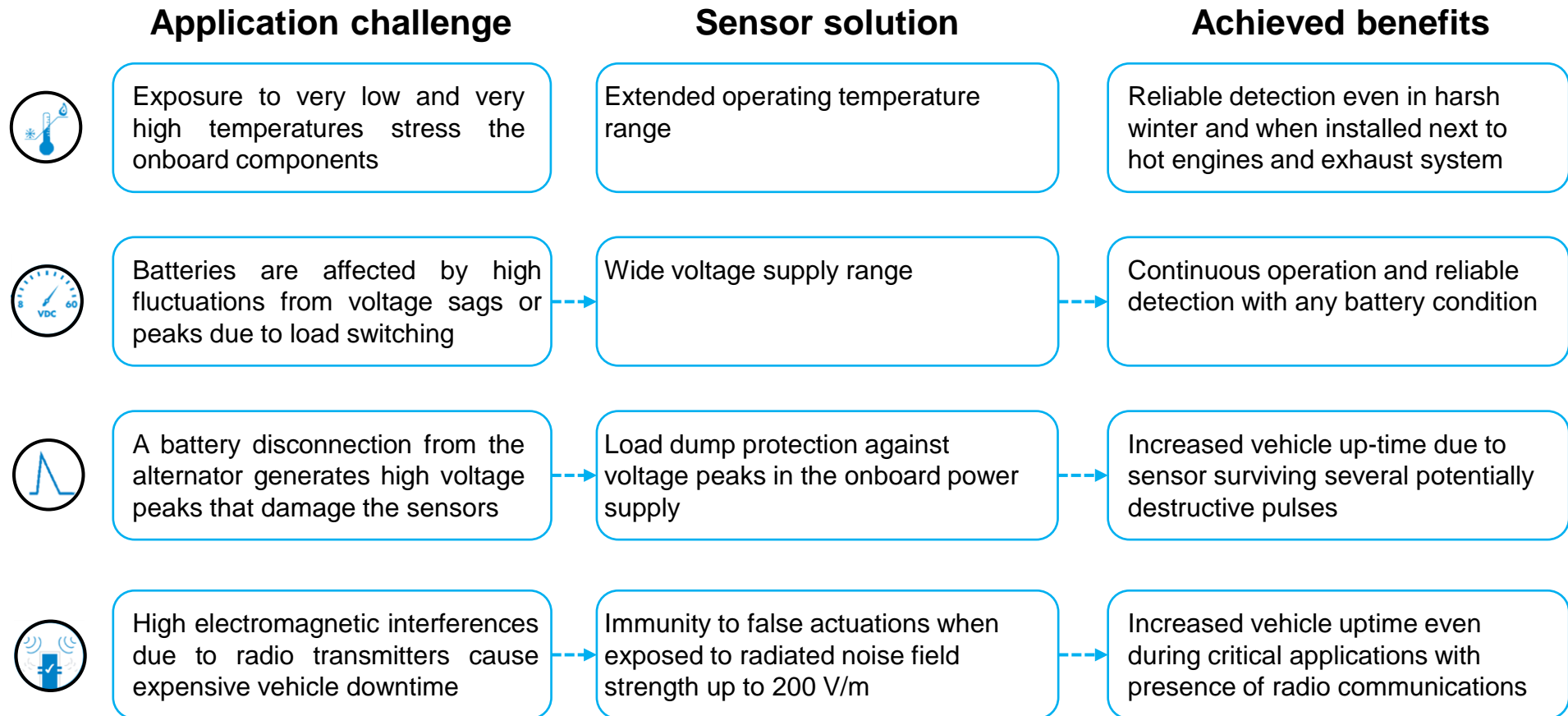


## Application Challenges





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## Sensor Requirements for Mobile Applications

### Mechanical Durability



Rough stainless steel housing AISI 304



Highest ingress protection grade

Vibration resistance  
20 g (EN 60068-2-6)



Salt spray  
(EN 60068-2-52 Kb)

Shock resistance 100 g  
and continuous 40 g shock  
(EN 60068-2-27 Ea)



Flush installation - full protection from potential impacts with target

## Sensor Requirements for Mobile Applications

### Electrical Protection



Extended power supply range



Load-dump protection



Overload protection



Reverse polarity protection

Short circuit protection



Transients protection



## Sensor Requirements for Mobile Applications

### EMC Performance



Radiated noise  
(ISO 11452-2)

200  
V/m

0.5 kV

Surge mains line to line  
(EN 61000-4-5)

Burst immunity  
(EN 61000-4-4)

4 kV

300  
A/m

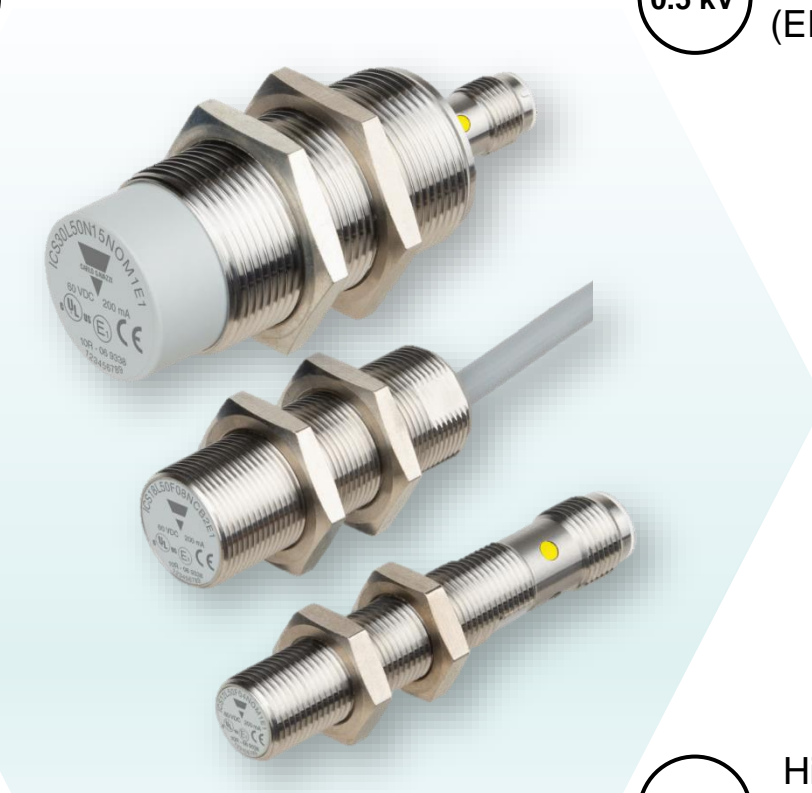
Power frequency  
magnetic fields  
(EN 61000-4-8)

Electrostatic discharge  
(EN 61000-4-2)

ESD

10 V

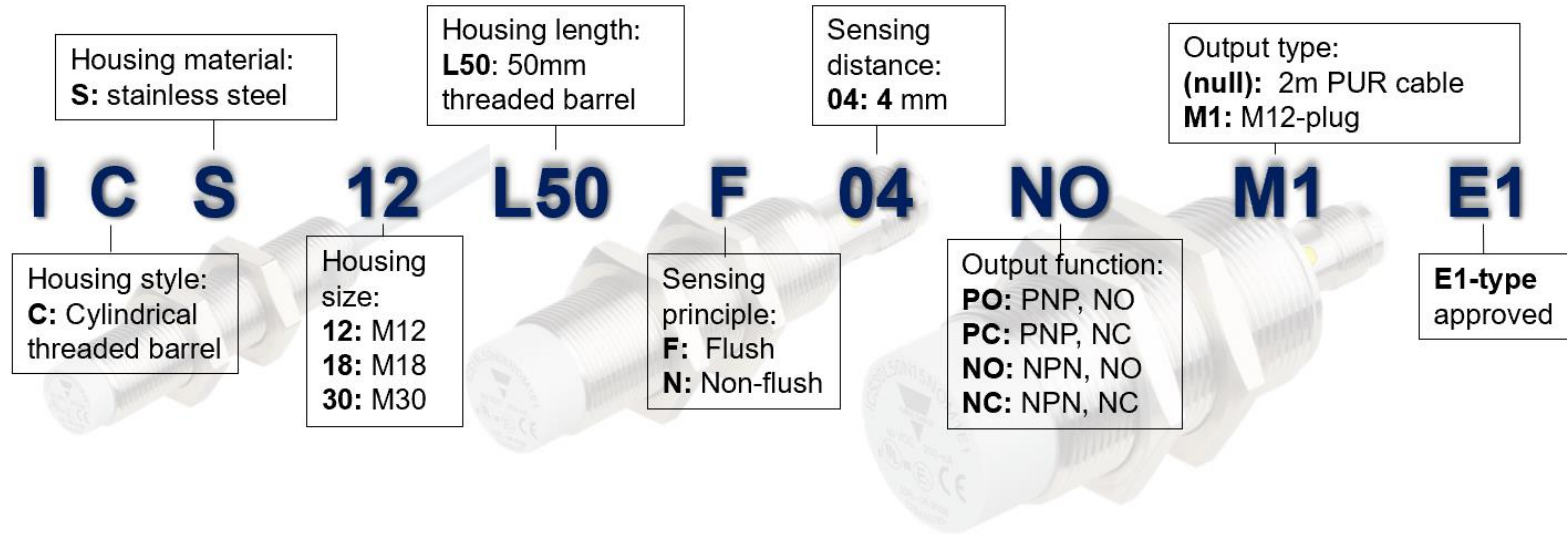
High frequency conducted  
radiofrequency  
(EN 61000-4-6)



# SENSORS for MOBILE EQUIPMENT



## Carlo Gavazzi ICS E1 for Mobile Equipment



Housing	Sn	Mounting	Connection	NPN - NO	PNP - NO	NPN - NC	PNP - NC
M12	4 mm	Flush	Cable	ICS12L50F04NOB2E1	ICS12L50F04POB2E1	ICS12L50F04NCB2E1	ICS12L50F04PCB2E1
			Plug	ICS12L50F04NOM1E1	ICS12L50F04POM1E1	ICS12L50F04NCM1E1	ICS12L50F04PCM1E1
	8 mm	Non-flush	Cable	ICS12L50N08NOB2E1	ICS12L50N08POB2E1	ICS12L50N08NCB2E1	ICS12L50N08PCB2E1
			Plug	ICS12L50N08NOM1E1	ICS12L50N08POM1E1	ICS12L50N08NCM1E1	ICS12L50N08PCM1E1
M18	8 mm	Flush	Cable	ICS18L50F08NOB2E1	ICS18L50F08POB2E1	ICS18L50F08NCB2E1	ICS18L50F08PCB2E1
			Plug	ICS18L50F08NOM1E1	ICS18L50F08POM1E1	ICS18L50F08NCM1E1	ICS18L50F08PCM1E1
	14 mm	Non-flush	Cable	ICS18L50N14NOB2E1	ICS18L50N14POB2E1	ICS18L50N14NCB2E1	ICS18L50N14PCB2E1
			Plug	ICS18L50N14NOM1E1	ICS18L50N14POM1E1	ICS18L50N14NCM1E1	ICS18L50N14PCM1E1
M30	15 mm	Flush	Cable	ICS30L50F15NOB2E1	ICS30L50F15POB2E1	ICS30L50F15NCB2E1	ICS30L50F15PCB2E1
			Plug	ICS30L50F15NOM1E1	ICS30L50F15POM1E1	ICS30L50F15NCM1E1	ICS30L50F15PCM1E1
	22 mm	Non-flush	Cable	ICS30L50N22NOB2E1	ICS30L50N22POB2E1	ICS30L50N22NCB2E1	ICS30L50N22PCB2E1
			Plug	ICS30L50N22NOM1E1	ICS30L50N22POM1E1	ICS30L50N22NCM1E1	ICS30L50N22PCM1E1



**Thank you for your attention!**