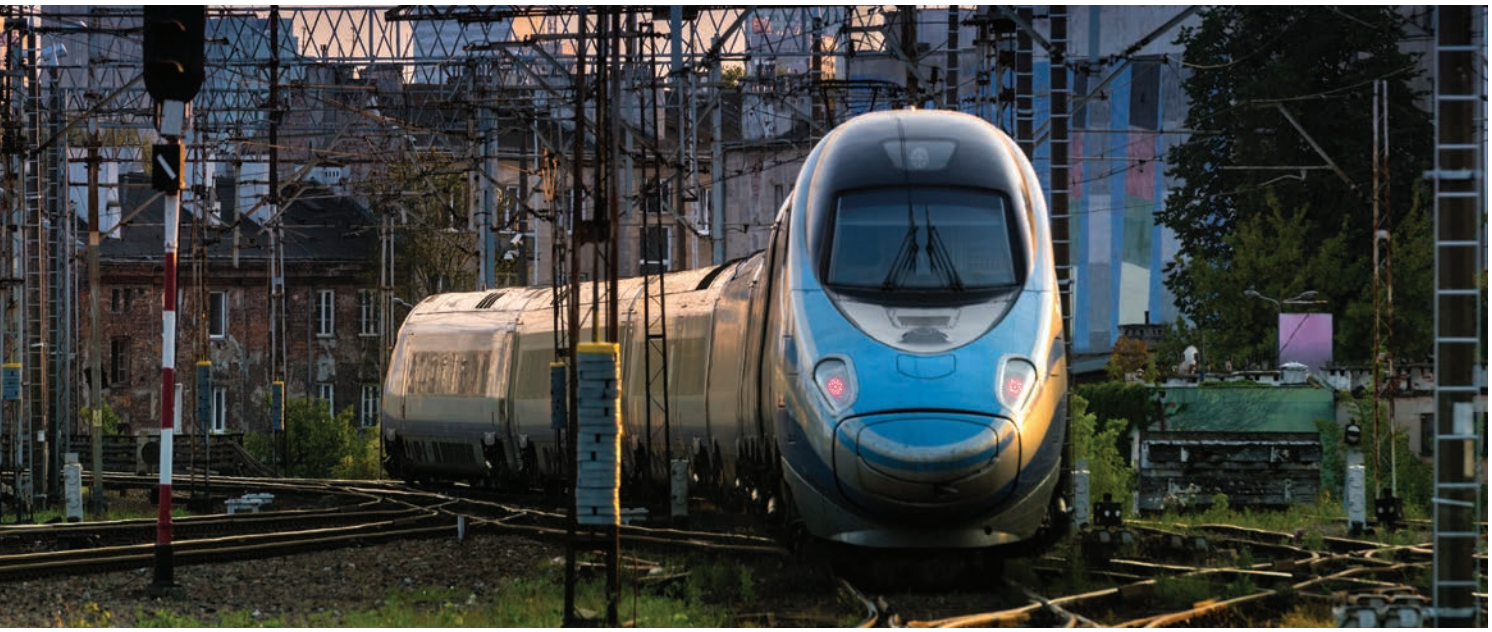
RAIL APPLICATIONS: ACCELEROMETERS, MICROPHONES & PRESSURE SENSORS

PCB PIEZOTRONICS
AN AMPHENOL COMPANY

pcb.com/rail | 1 800 828 8840

PCB'S HISTORY IN RAIL

PCB® has been involved in rail sensor design since 1998, at the request of a European customer who required an accelerometer to accurately detect the condition of bearings and low frequency lateral motion on high speed trains The field of high speed rail has progressed significantly with the addition of on-board monitoring to check the status and safety of trains, reduce maintenance costs and improve passenger comfort and safety. These systems use specially developed accelerometers for monitoring. PCB® designs rail accelerometers using the optimum technology type to meet the needs of the application. PCB® has typically used industrial-type sensors in these rail applications as the construction of these sensors are ideal for the rail environment which covers a wide range of ambient conditions. Working with an integrator has been critical to our success in rail monitoring programs as specification development can only occur with their input and is based on their requirements for sensor performance (frequency and sensitivity specifications), grounding strategy, environmental requirements (such as temperature, electric and mechanical shock and IP ratings) in addition to overall monitoring strategy. Our sensors have been used in Ride Comfort testing per EN12299, Bogie stability per EN13749, Track Geometry per EN 13848, and Dynamic testing per EN 14363. In addition to off-the-shelf stock accelerometers, PCB® is able to provide special accelerometers with TEDS, surge protection; filtering, case isolation, and low smoke zero halogen cables to meet specific rail standards depending on the particular application.



MONITORING

Bogie system monitoring is used to monitor the vibration of trains, and depending on the location, can be used for preventative maintenance, early detection of failure, bogie hunting, and ride quality. Bogie system monitoring is an essential component to train maintenance, which ensures that parameters such as the wear within the bearings, shafts, brakes, and wheels are identified and properly monitored. This allows repair work to be scheduled efficiently, drive down maintenance costs, and prevent potential instabilities that may cause an accident.

Condition monitoring offers opportunities to increase reliability and safety, and to achieve lower maintenance costs. Using condition detection systems and applying detailed algorithms for data processing can detect early damage and allow time for repairs before a mechanical failure occurs. Expenses will be saved in the long term with maintenance being scheduled during non-peak times to increase vehicle reliability.

Derailment prevention of high speed passenger trains is a extremely important safety system that uses very complex algorithms to detect irregular oscillations, when transmitted to the operator or automatically shutdown the system. The requirement for safety monitoring creates the need to make a real-time decision based on provided data.

RIDE CONTROL (MONITORING RIDE AND COMFORT QUALITY)

Passenger ride quality is an important factor in rider comfort. Track irregularities are transmitted to the passenger and their frequency and amplitude (especially laterally) must be measured to determine the effect on comfort quality. PCB® has sensors and microphones that can be used to measure these characteristics. Our sensors have been used in ride comfort testing per EN12299.

VIBRATION

Rail systems use specially developed accelerometers for monitoring that meet strict environmental and safety standards. PCB® designs rail accelerometers using the optimum technology type to meet the needs of the application. Industrial type sensors are used in these rail applications as the construction of these sensors are ideal for the rail environment which covers a wide range of ambient conditions. In addition to the below stock accelerometers, PCB® is able to provide custom accelerometers with TEDS, surge protection, frequency filtering, electrical isolation, as well as specialized cables that meet specific environmental and rail standards. PCB's sensors have been used in various types of testing including Bogie stability per EN13749, Track Geometry per EN 13848, and Dynamic testing per EN 14363.

LOW PROFILE, INDUSTRIAL, ICP® ACCELEROMETER

MODEL 602D11

Sensitivity: (±10%) 100 mV/g (10.2 mV/(m/s²))

Measurement Range: ±50 g (±490 m/s²)

Frequency Range: (±3dB) 0.5 to 8000 Hz

GENERAL PURPOSE, INDUSTRIAL, ICP® ACCELEROMETER

MODEL 603C01

Sensitivity: (±10%) 100 mV/g (10.2 mV/(m/s²))

Measurement Range: ±50 g (±490 m/s²)

Frequency Range: (±3dB) 0.5 to 10000 Hz

RING-STYLE, INDUSTRIAL, ICP® ACCELEROMETER

MODEL 606B01

Sensitivity: (±20%) 100 mV/g (10.2 mV/(m/s²))

Measurement Range: ±50 g (±490 m/s²)

Frequency Range: (±3dB) 0.5 to 10000 Hz

LOW PROFILE INDUSTRIAL ICP® ACCELEROMETER

MODEL 607A61

Sensitivity: (±15%) 100 mV/g (10.2 mV/(m/s²))

Measurement Range: ±50 g (±490 m/s²)

Frequency Range: (±3dB) 0.5 to 10000 Hz

MODAL ARRAY, ICP® ACCELEROMETER

MODEL 333B40

Sensitivity: (±10%) 500 mV/g (51.0 mV/(m/s²))

Measurement Range: ±10 g pk (±98 m/s² pk)

Frequency Range: (±5%) 0.5 to 3000 Hz

TRIAXIAL ICP® SEAT PAD ACCELEROMETER

MODEL 356B41

Sensitivity: (±10%) 100 mV/g (10.2 mV/(m/s2))

Measurement Range: ±10 g pk (±98 m/s² pk)

Frequency Range: (±5%) 0.5 to 1000 Hz

MEMS DC ACCELEROMETERS
SERIES 3711F

Sensitivities available from (± 3%) 6.75 mV/g (68.8 mV/s²) to 6.75 mV/g (0.69 mV/(m/s²)

Measurement Range available from: ±2 g pk(±19.6 m/s² pk) to ±200 g pk(±1962 m/s² pk)

Frequency Range available from: (±5%) 0 to 250 Hz to 0 to 1500 Hz

TRIAXIAL MEMS DC ACCELEROMETERS
SERIES 3713F

Sensitivities available from (± 3%) 6.75 mV/g (68.8 mV/s²) to 6.75 mV/g (0.69 mV/(m/s²)

Measurement Range available from: ±2 g pk(±19.6 m/s² pk) to ±200 g pk(±1962 m/s² pk))

Frequency Range available from: (±5%) 0 to 250 Hz to 0 to 1500 Hz

DIFFERENTIAL MEMS DC ACCELEROMETERS
SERIES 3741F

Sensitivities available from (± 3%) 13.5 mV/g (1.38 mV/(m/s²) to 1350 mV/g (137.6 mV/(m/s²)

Measurement Range available from: ±2 g pk(±19.6 m/s² pk to ±200 g pk(±1962 m/s² pk)

Frequency Range available from: (±5%) 0 to 250 Hz to 0 to 1000 Hz

TRIAXIAL, GENERAL PURPOSE, ICP® ACCELEROMETER
MODEL 356A02

Sensitivity: (±10%) 10 mV/g (1.02 mV/(m/s²))

Measurement Range: ±500 g pk (±4900 m/s² pk) (±490 m/s²)

Frequency Range: (±5%) 1 to 5000 Hz

TRIAXIAL, ICP® ACCELEROMETER
MODEL HT356A66

Sensitivity: (±10%) 10 mV/g (1.02 mV/(m/s²))

Measurement Range: ±500 g pk (±4900 m/s² pk))

Frequency Range: (±5%) 2 to 4000 Hz

LOW COST EMBEDDABLE ACCELEROMETER
MODEL RHHT66102APZ1

Sensitivity: (±20%) 10 mV/g (1.02 mV/(m/s²))

Measurement Range: 500 g (5000 m/s²)

Frequency Range: (±3dB) 0.5 to 5k Hz

NOISE

PCB® microphones can be used to measure acoustic fields within and around train cars. Customer satisfaction and overall ride quality are directly tied to the types of noises an individual may experience during their trip. PCB® microphones meet all applicable IEC standards for test and measurement microphones, and have excellent frequency and amplitude response to ensure accurate measurements in a wide variety of rail applications.

1/4" FREE-FIELD ICP® ARRAY MICROPHONE SYSTEM

MODEL 130F20

- Low Noise Floor: 24 dBA
- Frequency Range: 10 Hz - 20 kHz (±4 dB)
- Electrical Connector: BNC Jack (Typical)

1/4" FREE-FIELD ICP® ARRAY MICROPHONE SYSTEM

MODEL 130F21

- Low Noise Floor: 24 dBA
- Frequency Range: 10 Hz - 20 kHz (±4 dB)
- Electrical Connector: 10-31 coaxial jack

1/4" FREE-FIELD ICP® ARRAY MICROPHONE SYSTEM

MODEL 130F22

- Low Noise Floor: 24 dBA
- Frequency Range: 10 Hz - 20 kHz (±4 dB)
- Electrical Connector: SMB coaxial socket

1/2" WATER AND DUST RESISTANT ICP® MICROPHONE SYSTEM

MODEL 130A24

- Sensitivity: 10 mV/Pa
- Frequency Range: 20 Hz - 16 kHz (±3 dB)
- IP55 Rated for harsh environments

1/2" LOW NOISE ICP® PREPOLARIZED MICROPHONE SYSTEM

MODEL 378A04

- Less than 6.5 dBA noise floor
- Frequency Range: 5 Hz to 20 kHz
- High sensitivity, 450 mV/Pa
- Electrical connector: BNC Jack

1/2" FREE-FIELD ICP® MICROPHONE SYSTEM

MODEL 378B02

- Sensitivity: 50 mV/Pa
- Frequency Range: 3.75 Hz – 20 kHz
- Dynamic Range: 137 dB re 20 µPa (± 2 dB) (Typical)

SURFACE MICROPHONE

MODEL 130B40

- Sensitivity: (±3 dB) 8.5 mV/Pa
- Dynamic Range: 150 dB before clipping
- Electrical Connector: 10-32 Coaxial plug

PRESSURE

Dynamic air pressure measurements are critical in the comfort and safety of trains and passengers. Endevco pressure sensors are used in measuring air pressure in tunnels when trains are entering, passing through and exiting tunnels and stations. The sensors are mounted in various locations such as the tunnels walls or on the train. Additionally, Endevco dynamic sensors are used in Rail wind tunnel tests.

PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8510B

- 200, 500, 2000 psig ranges
- 300 mV full scale
- Gage

PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8515C

- 15 and 50 psia ranges
- 200 mV full scale
- Absolute reference

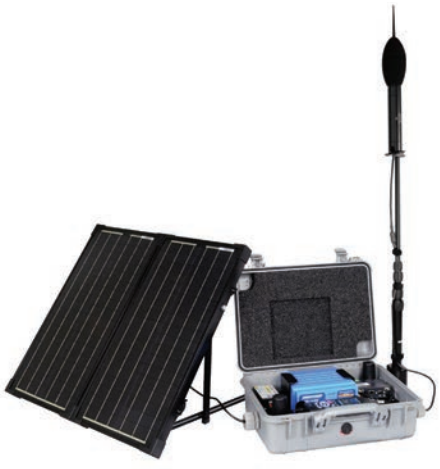
PIEZORESISTIVE PRESSURE TRANSDUCER
MODEL 8530C

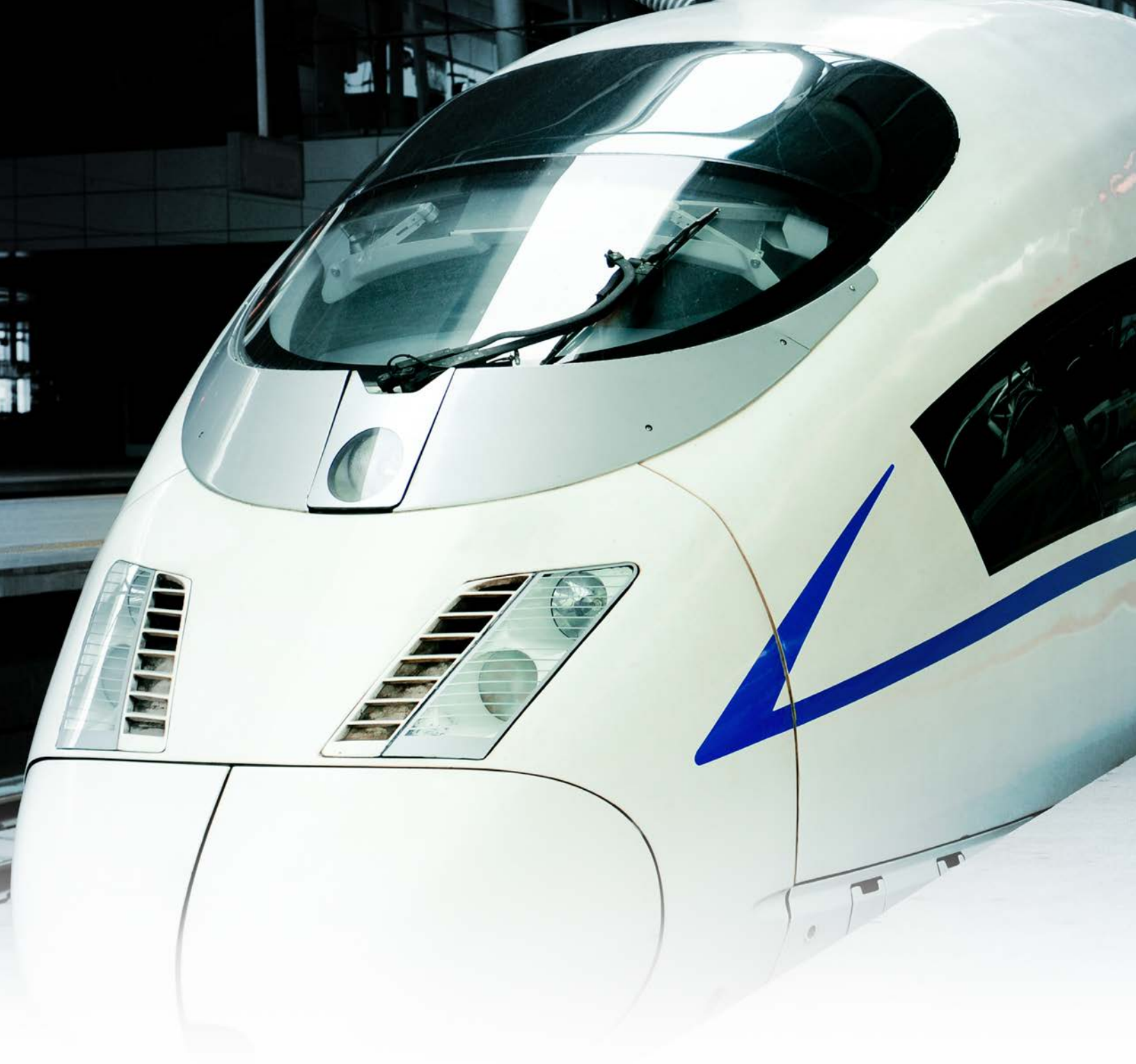
- 15, 50 and 100 psia ranges
- 225 mV full scale
- Absolute reference

LARSON DAVIS
A PCB DIVISION

SOUNDADVISOR™ PORTABLE NOISE MONITORING
MODEL NMS044

- Remote 24/7 monitoring
- Easy deployment in the field
- Solar power options
- Real-time exceedance and event alerts





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