alpha diagnostics

Corporate Presentation

Alpha Diagnostics Ltd

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info@alphadiagnostics.ch

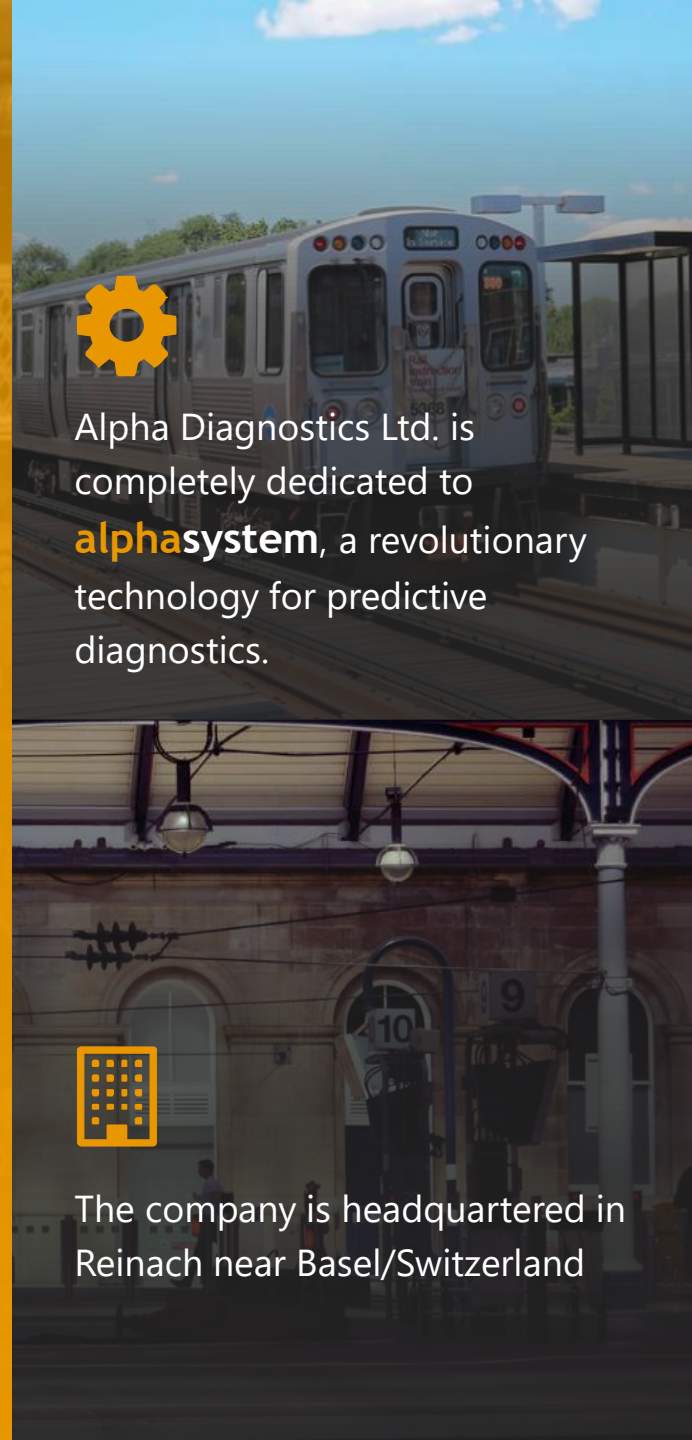
Contents

Alpha Diagnostics Ltd

Alpha Diagnostics Ltd was incorporated in April 2018 as a public limited company based in Switzerland.

The founding members have many years of experience in predictive diagnostics:

- Markus Eigenmann, former CEO of JAQUET Technology Group
- Dr. Oliver Hirsch, former Head of Diagnostic Systems @JAQUET Technology Group
- Dr. Ratnesh Thapliyal, former Head of Business Development @JAQUET Technology Group
- Marcos Barandun, former System Architect @JAQUET Technology Group

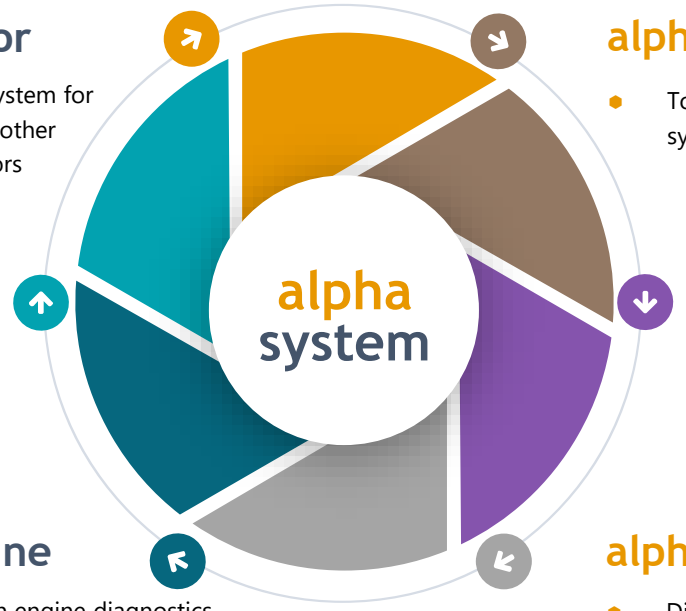


Alpha Diagnostics Ltd. is completely dedicated to **alphasystem**, a revolutionary technology for predictive diagnostics.

The company is headquartered in Reinach near Basel/Switzerland

alphasystem - The World's Most Advanced Predictive Diagnostic Tool

- **Considerable savings in fuel consumption & overall efficiency**
- **Eliminate catastrophic breakdowns**
- **Extend overhaul intervals safely**
- **Easy to install & retrofit**
- **Reduce operational costs – ROI in less than six months**



alphamotor

- Diagnostic system for traction and other electric motors

alphatorque

- Torque measurement and diagnostic system

alphagearbox

- Diagnostic system for gearboxes

alphabearing

- Bearing diagnostics system for rolling-element (ball and roller) bearings, plain (journal and sleeve) bearings

alphaengine

- Combustion engine diagnostics
- Any type of diesel, natural gas and petrol engines
- 2/4 stroke, inline/V type, up to 30 cylinders

alphacompressor

- Diagnostic system for compressors, e.g. integral reciprocating compressors.

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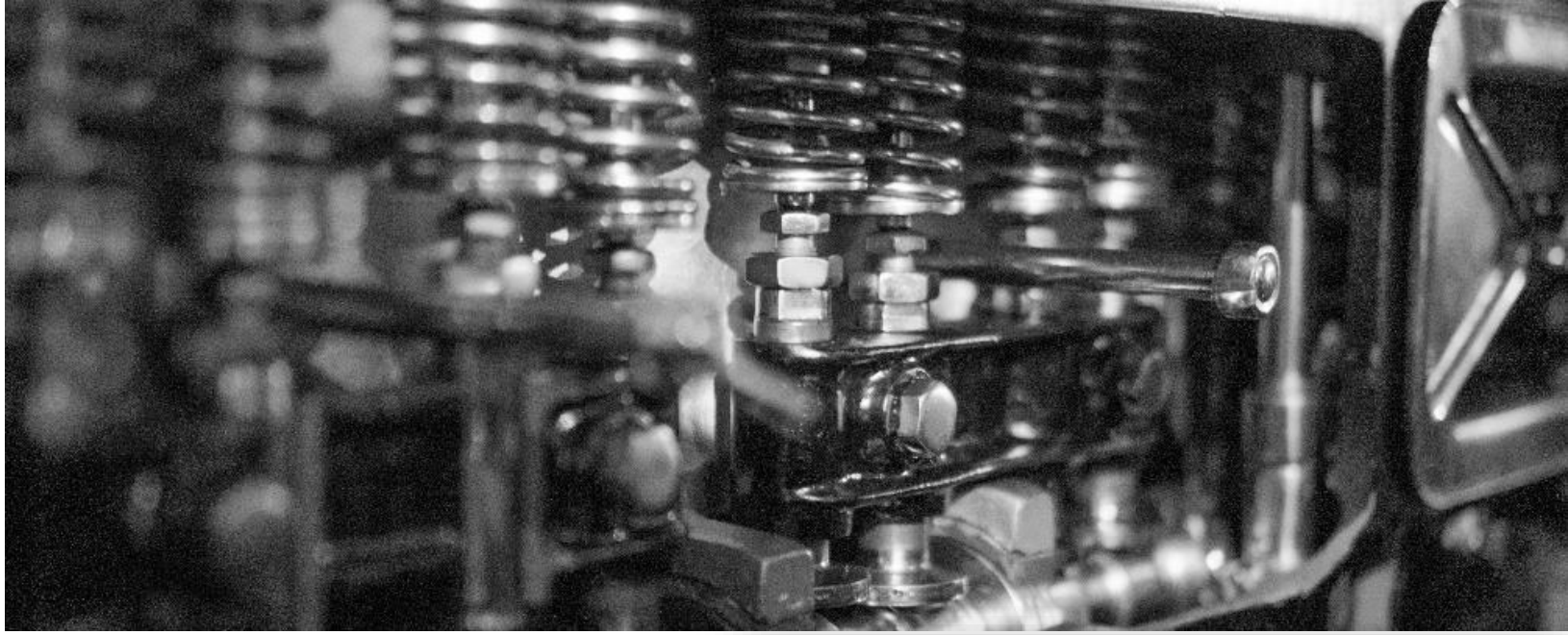
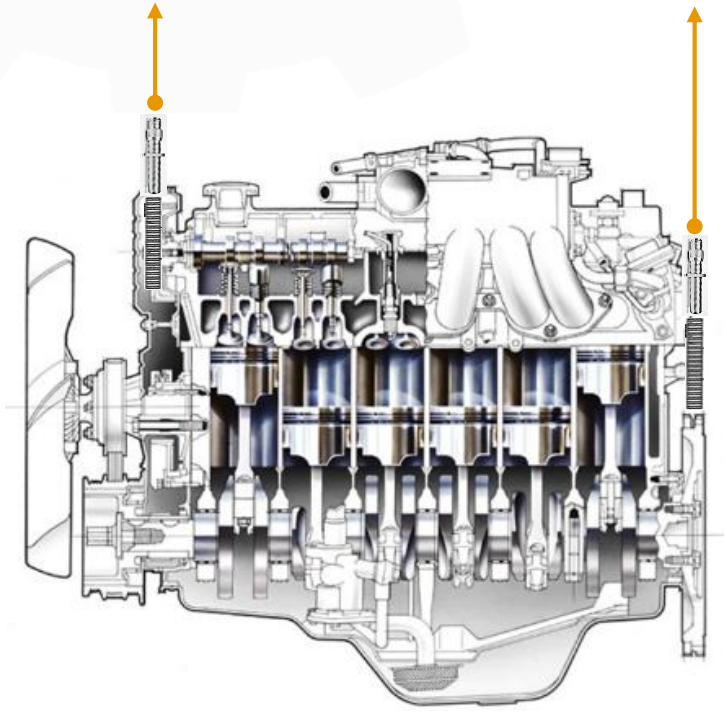
Combustion Engine Analysis





Required inputs:

- Speed sensor
  - Crankshaft
  - Camshaft (4-stroke) or TDC (2-stroke)
- Firing order
- Number of teeth on gear wheel
  - At least 60 pulses per revolution
- Engine type: V type or inline
- Fuel type: Diesel or natural gas

alphaengine

- 2-stroke or 4-stroke
- Diesel or natural gas
- Inline or V-type
- Up to 30 cylinders
- Up to 11 indicators

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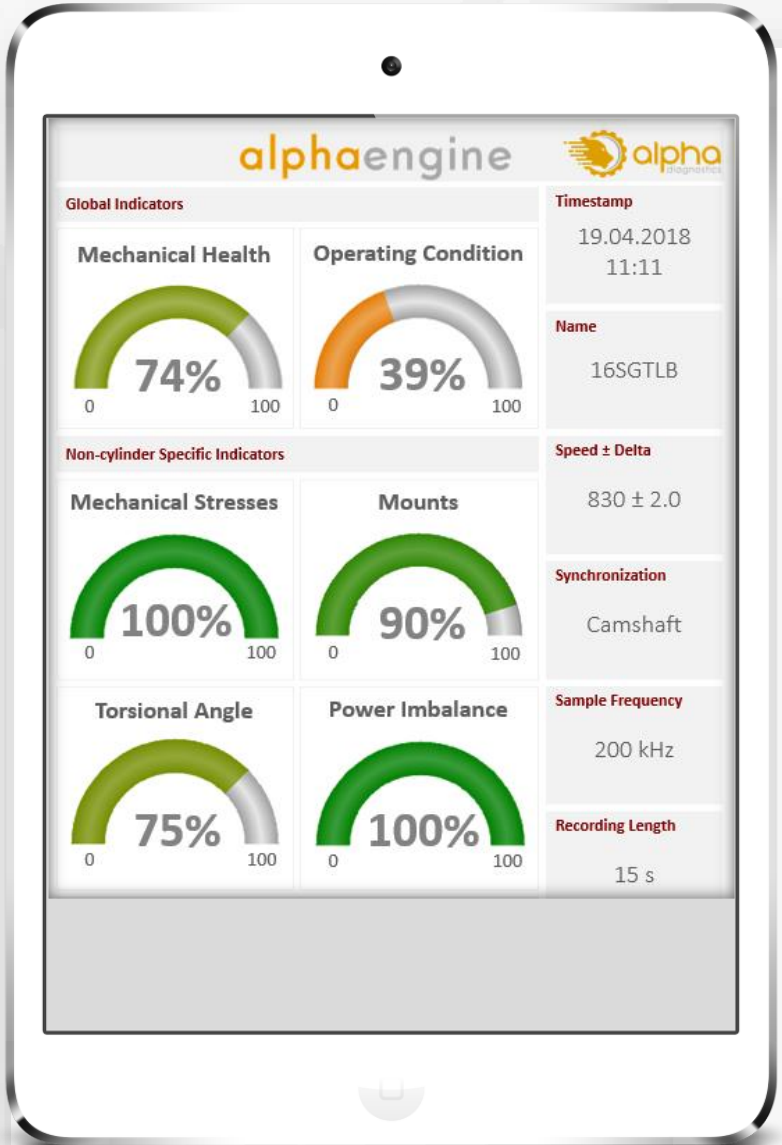
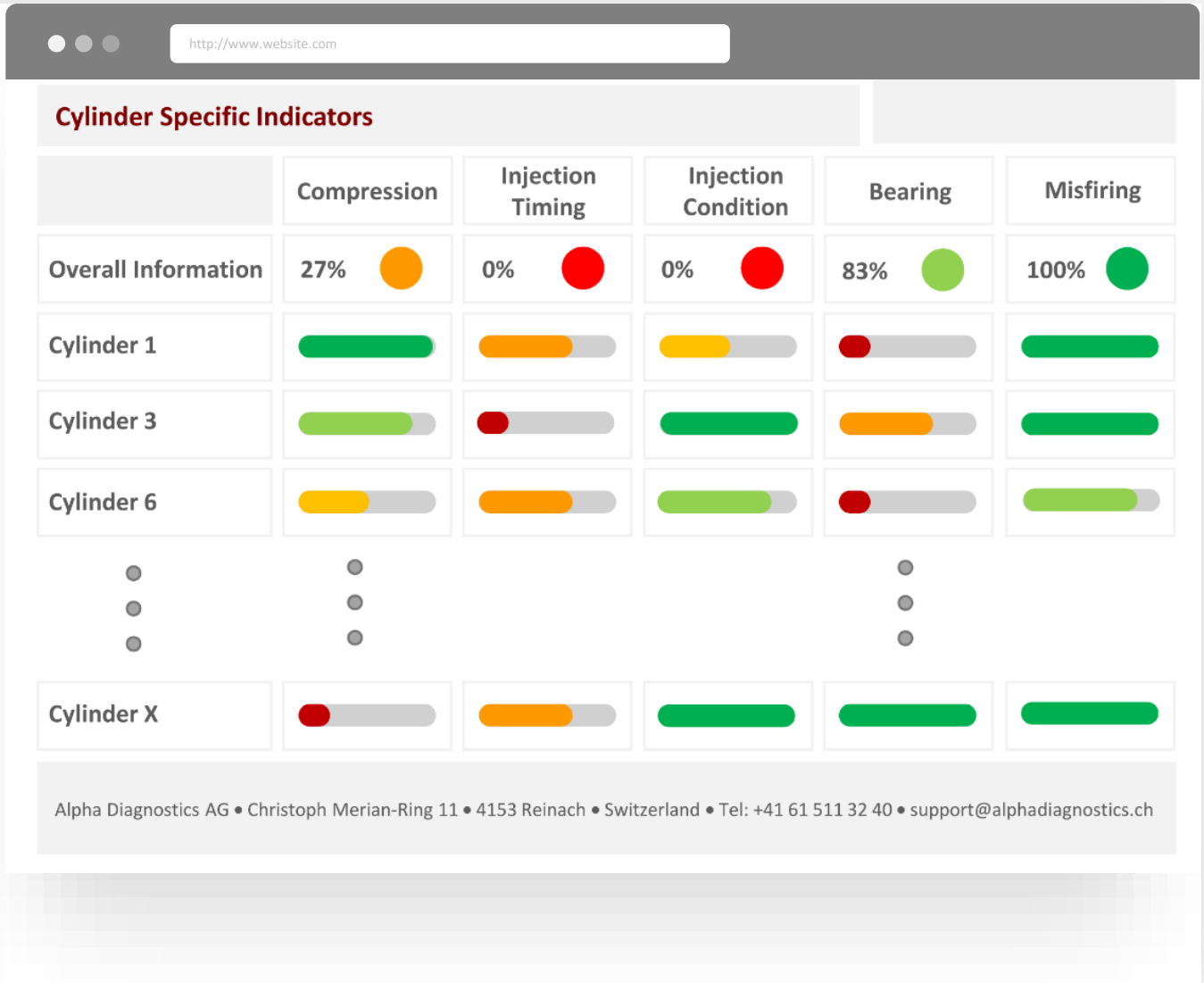
Results from Engine Analysis





Turbocharger Analysis

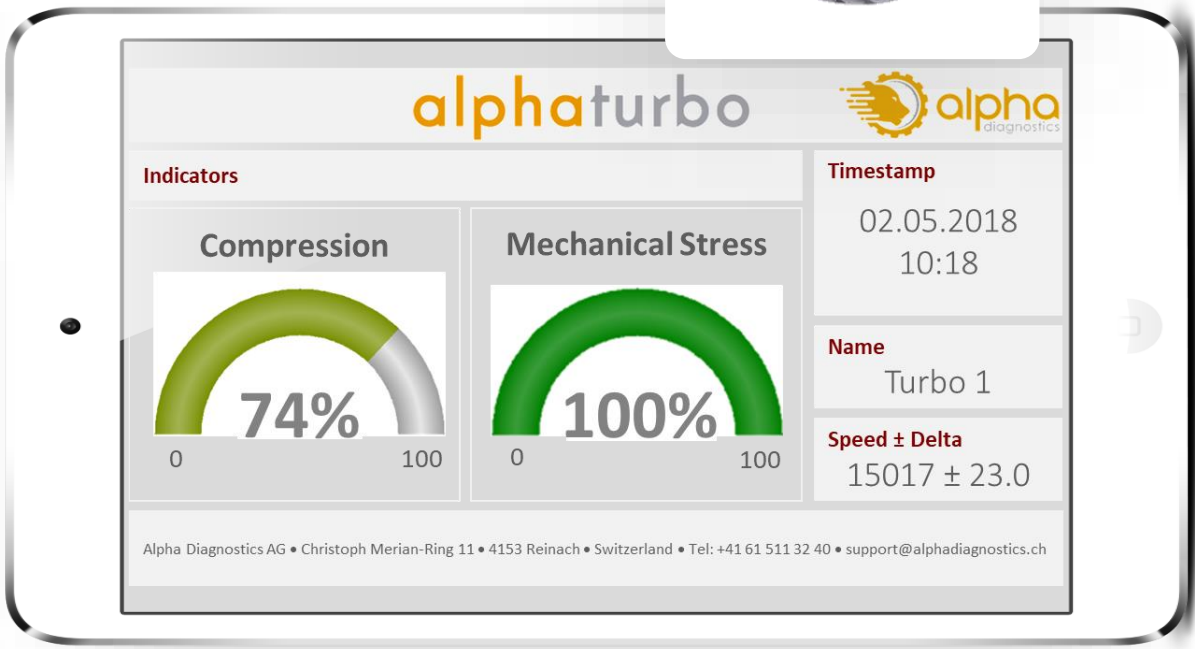
This module is available as an option to **alphaengine**.

Requirements

- At least 6 pulses per revolution

Indicators

- Compression
  - Speed variation due to bearing friction
  - Mechanical efficiency of turbine compressor and rotor shaft
- Mechanical Stress
  - Detection of shocks
  - Mechanical damage of turbine compressor and rotor shaft



Analysed Engines

Marine

- MAN 8L48/60CR, 4 stroke, 8L
- ABC 12VDZC, 4 stroke, V12
- Mitsubishi S16R-MPTA, 4 stroke, 16V
- Cummins QSK60, 4 stroke, 16V
- Cummins QSK38, 4 stroke, 12V
- MaK 6M32C, 4 stroke, 6L
- Cummins NTA855; 4 stroke, 6L
- Wärtsilä 9L20; 4 stroke, 9L
- Caterpillar 3046M1, 4 stroke, 6L
- Cummins KTA50G3M, 4 stroke, V16

Test Benches

- Hyundai Himsen 12H17V, 4 stroke, V12
- Volvo D6A210, 4 stroke, 6L
- Caterpillar 3512B, 4 stroke, 12V
- Kirloskar DC12, 4 stroke, 12V
- Kirloskar SL90, 4 stroke, 6L
- MTU V12 MB 838, 4 stroke, 12V
- MTU 20V 4000 M93L, 4 stroke, 20V
- Greaves Cotton New D Series, 4 stroke, 12V

Power Generator

- IVECO F3BE0685B, 4 stroke, 6L
- Hyundai Himsen 9H2533, 4 stroke, 9L
- MAN 18V 48-60B, 4 stroke, 18V
- Wärtsilä UD45, 4 stroke, 20V
- Wärtsilä W20V34, 4 stroke, 20V, natural gas
- Mirrlees ESL 16 MK2, 4 stroke, 16V
- SWD 9TM 410RR, 4 stroke, 9L
- Caterpillar 3412 DITA, 4 stroke, 12V

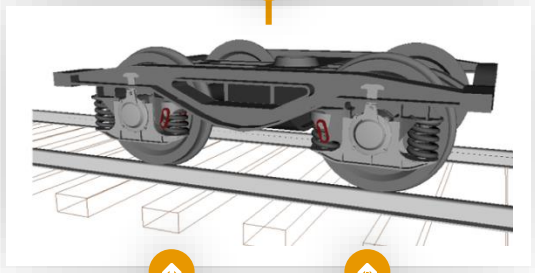
Railway

- General Electric 7-FDL-16E16, 4 stroke, V16
- General Electric 7-FDL-12, 4 stroke, V12
- Kolomna 12D49M, 4 stroke, V12
- Kolomna 2A-5D49, 4 stroke, V16
- Cummins QSK 19, 4 stroke, 6L
- ALCO V-16 251E, 4 stroke, V16
- MTU 4000, 4 stroke, V16
- EMD 710, 2 stroke, V16

Oil & Gas

- Superior 16SGTD, 4-stroke, V16, natural gas

Bearing Analysis



Speed sensors detect targets on the wheelset

Speed Sensor

Speed Sensor

alphabearing

Application

- Condition monitoring of axle bearings of bogies (example: railcar GTW2/6 in Switzerland)

Problem Area

- Non working train due to major damage of axle bearing during normal operation

Causes

- Improper mounting
- Poor lubrication
- Excessive load

Result

- Detection of deterioration of the condition of a bearing.
- Prediction of potential bearing problem
- Notification sent to maintenance team

Bearing Analysis

Requirements

- At least 60 pulses per revolution
- One speed sensor close to target bearing
- Speed sensors (coil, Hall-effect, optical)
- Usable in all kind of applications (railway, industry, etc.)

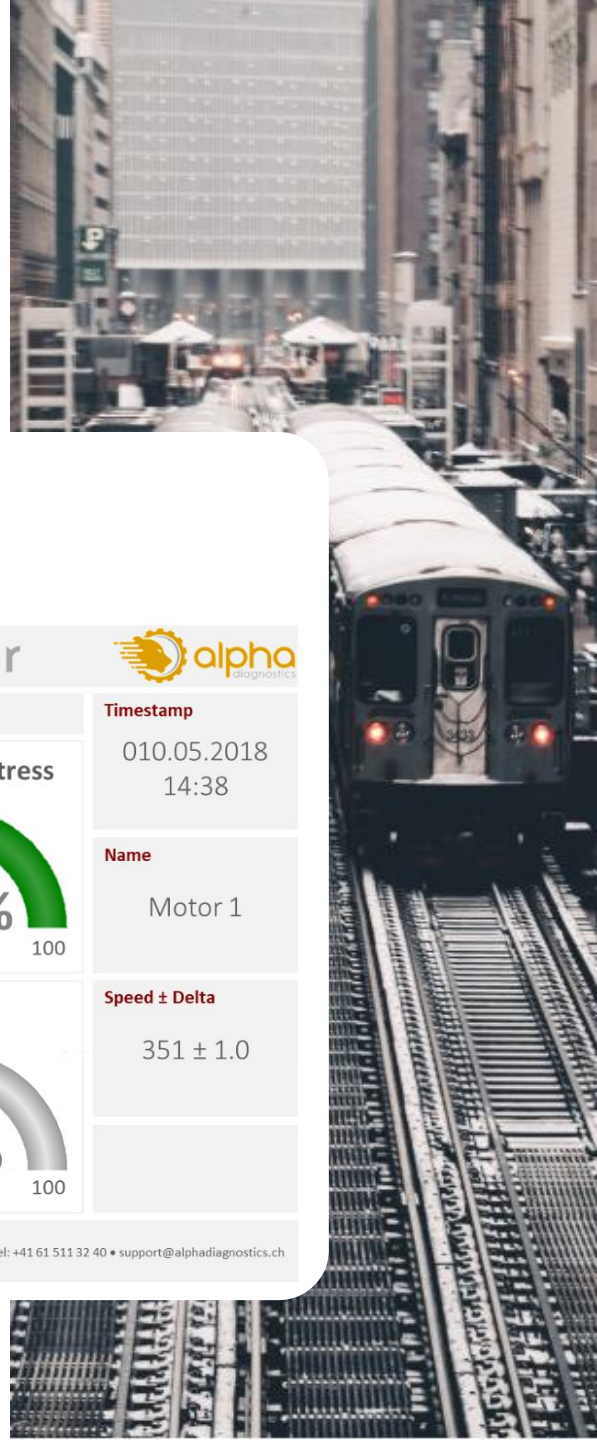
Traction/Electric Motor Analysis

Requirements

- At least 60 pulses per revolution
- One speed sensor close to motor
- Optical or speed sensors (coil or Hall-effect)
- Usable in all kind of applications (railway, industry, etc.)

The Basics of Motor Faults

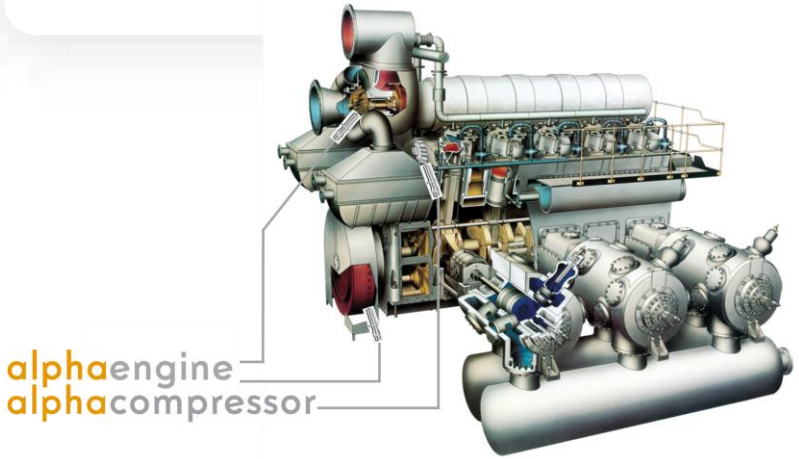
- Defects in motors can be caused, inter alia, by following reasons:
  - Over-Current
  - Over heating
  - Vibration
  - Low resistance
  - Dirt

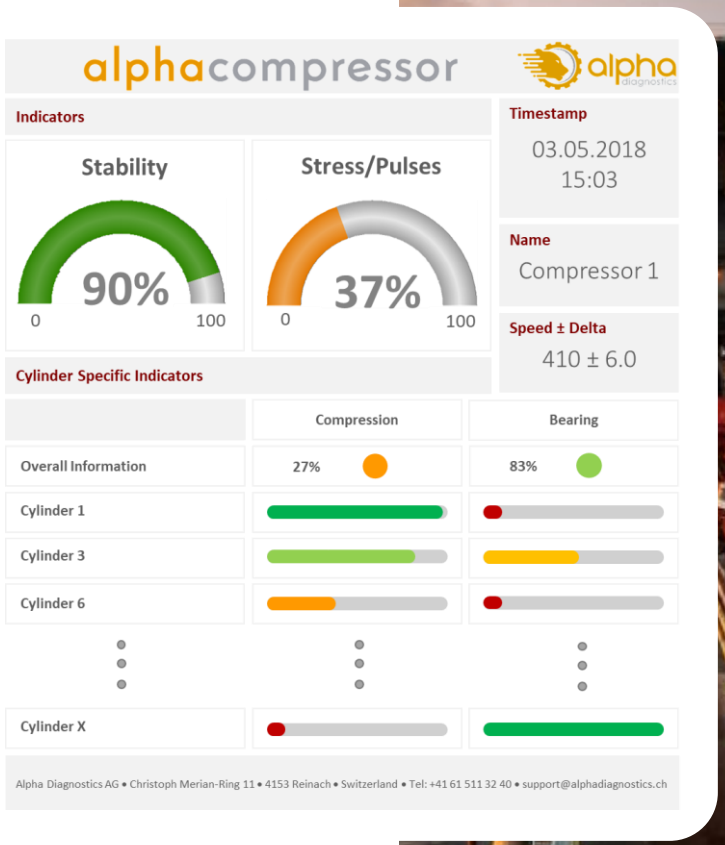


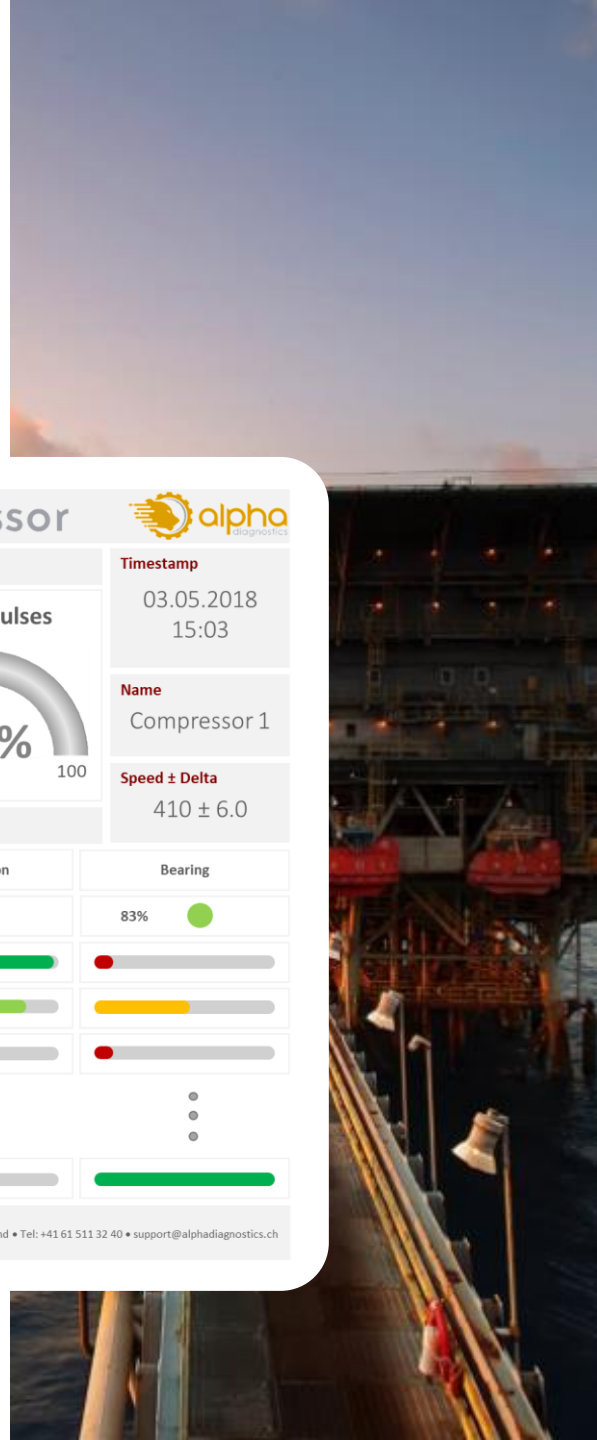
Reciprocating Compressors

Needed components:

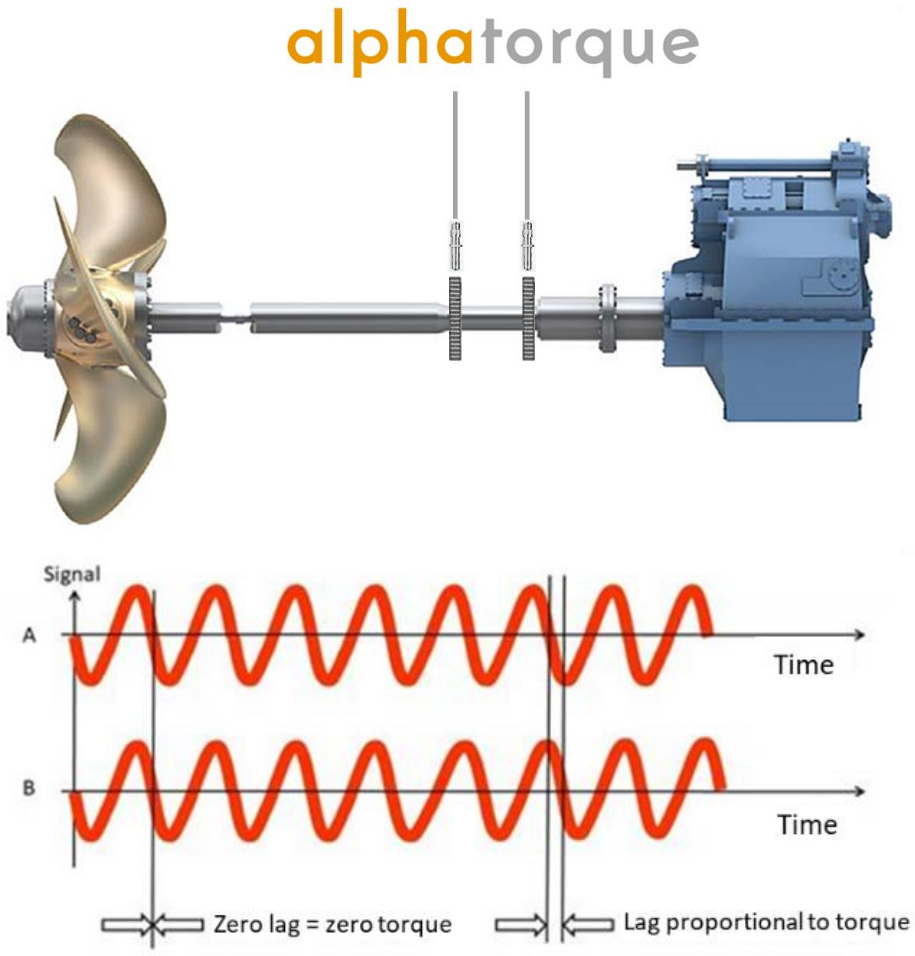
- Two speed sensors:
- on crankshaft having a target with at least 60 pulses per revolution installed close to first cylinder
- one to get a signal if one cylinder is at Top Dead Center (TDC) for pinpointing of cylinders
- For correct pinpointing: phase shift of each cylinder being at TDC.







Torque Measurement



alphaengine calculates dynamic and static torque based on measurement from two targets in any desired position on shaft or other rotating part.

Requirements:

- At least 60 pulses per revolution
- Optical or speed sensors (coil or Hall-effect)
- Two flywheels on shaft with speed sensor on each
- Minimum distance between two flywheel: 500mm

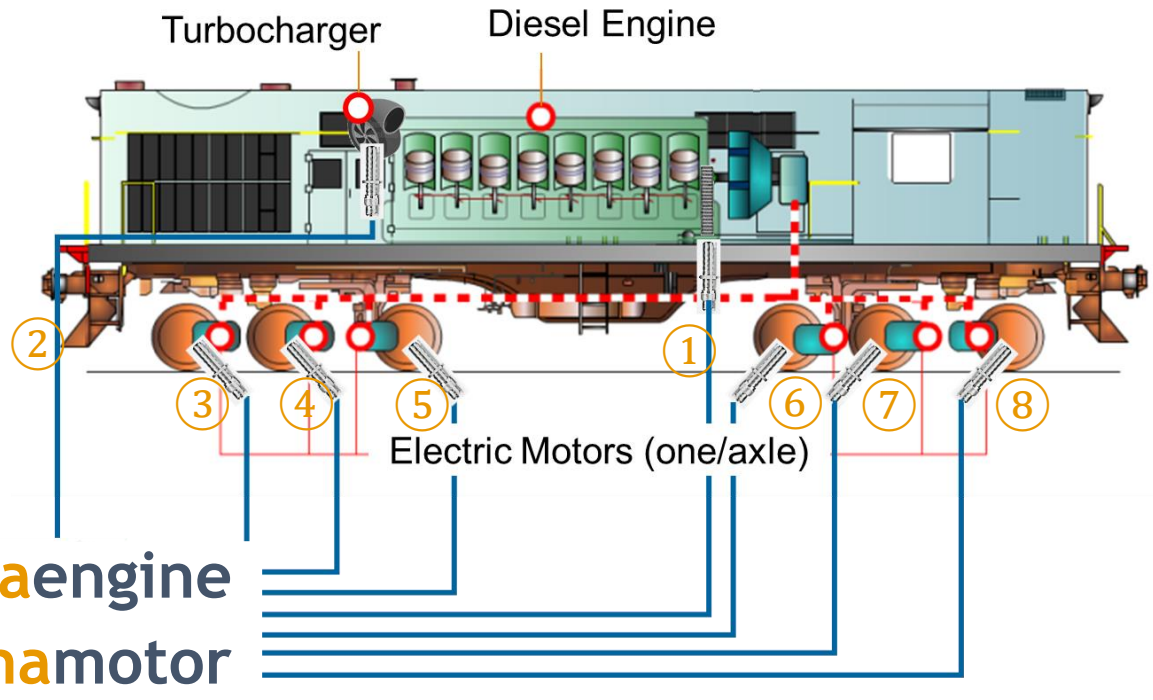
Provided output:

- Shaft RPM
- Shaft Static Torque
- Shaft Dynamic Torque
- Power transferred by the shaft

Typical Applications for alphasystem

Railway Applications (1)

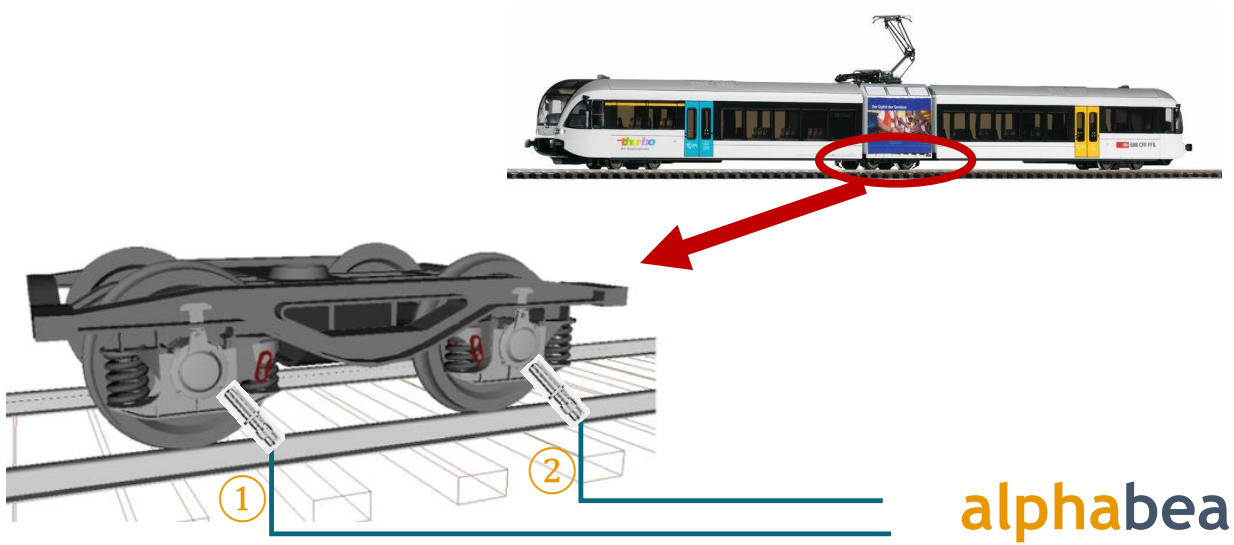
Function	Sensor
Diesel Engine	①+Synch. Signal
Turbocharger	②
Electric Motor	③④⑤⑥⑦⑧



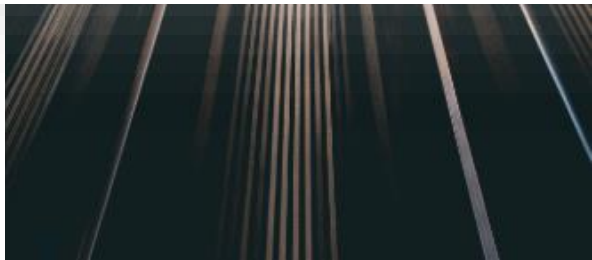
Railway Applications (2)

Function	Sensor
Axle Bearing Analysis	①②

Axle Bearing Analysis

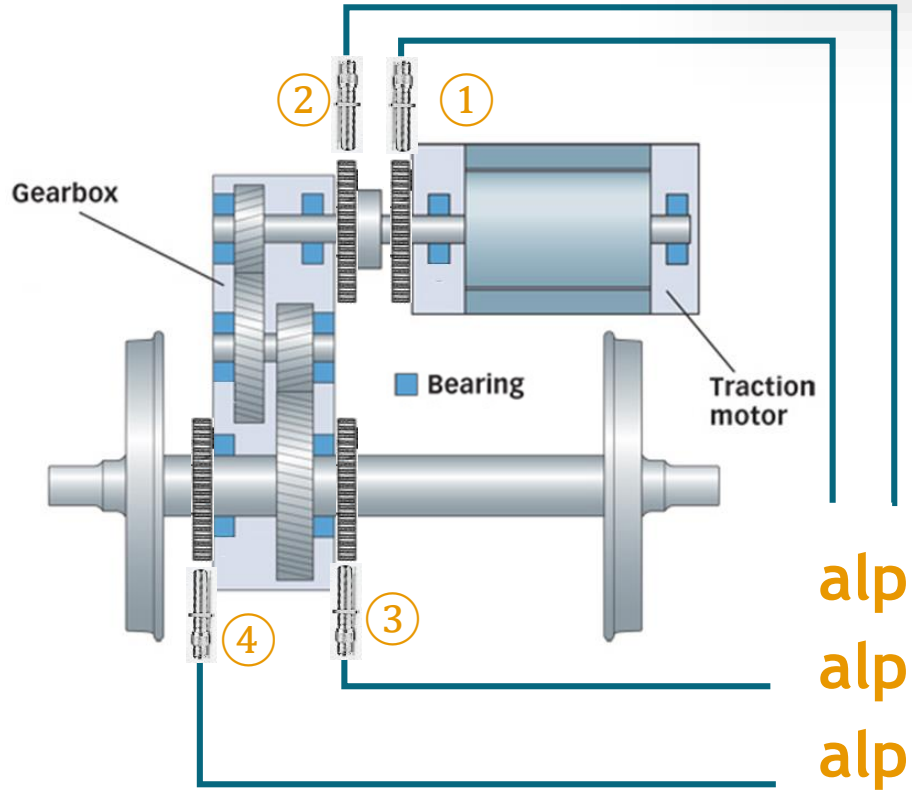


alphabearing



Railway Applications (3)

Electric Multiple Unit Application



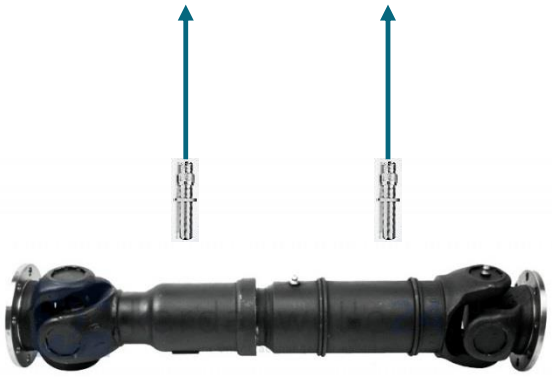
Function	Sensor
Traction Motor Diagnosis	①
Gearbox Diagnosis	②③④
Bearing Diagnosis	①②③④

alphamotor
alphabearing
alphagearbox

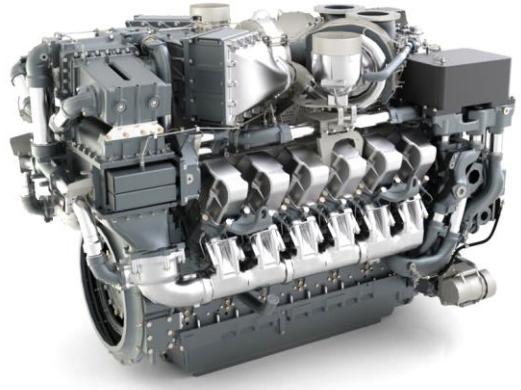
Railway Applications (4)

Gearbox

alphatorque

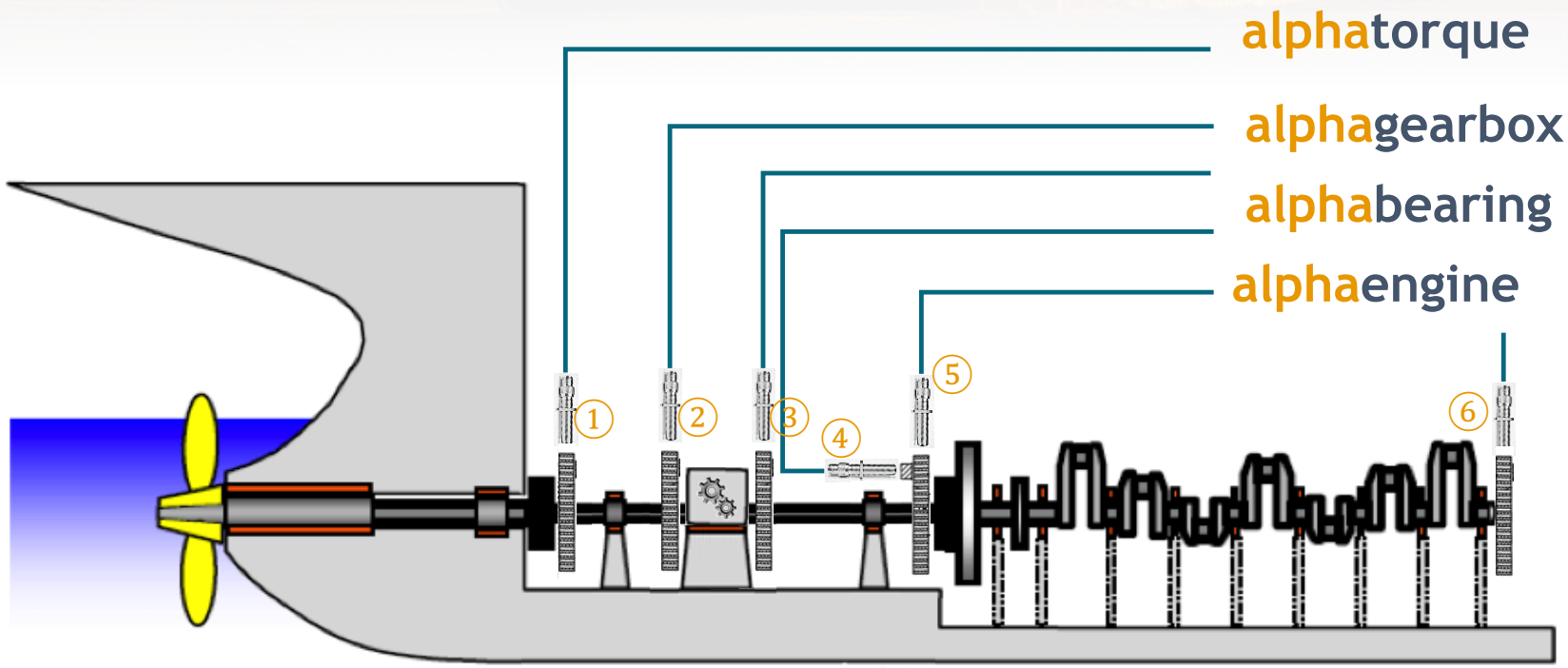


Shaft between gearbox and diesel engine



Diesel engine

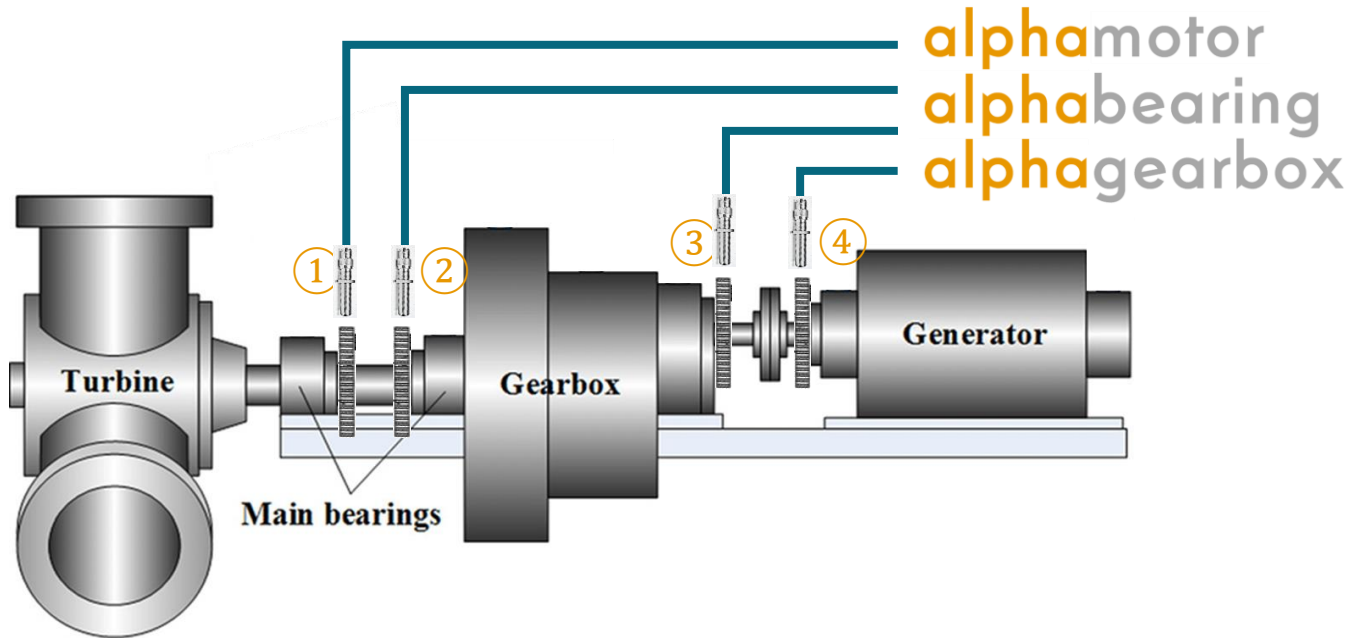
Marine Applications



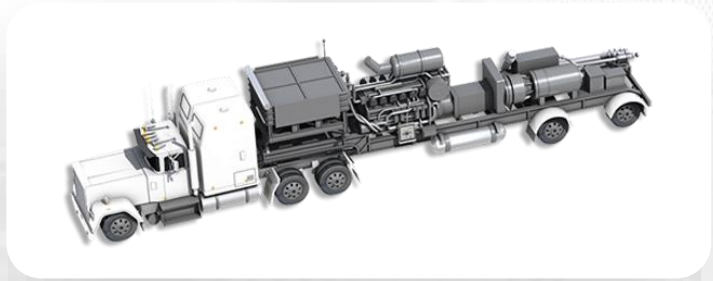
Function	Sensor
Torque Measurement	①②/③⑤
Propeller Analysis	①
Propeller Bearing Analysis	①
Engine Diagnosis	④⑤
Engine Power Calculation	⑤⑥
Gearbox Diagnosis	②③

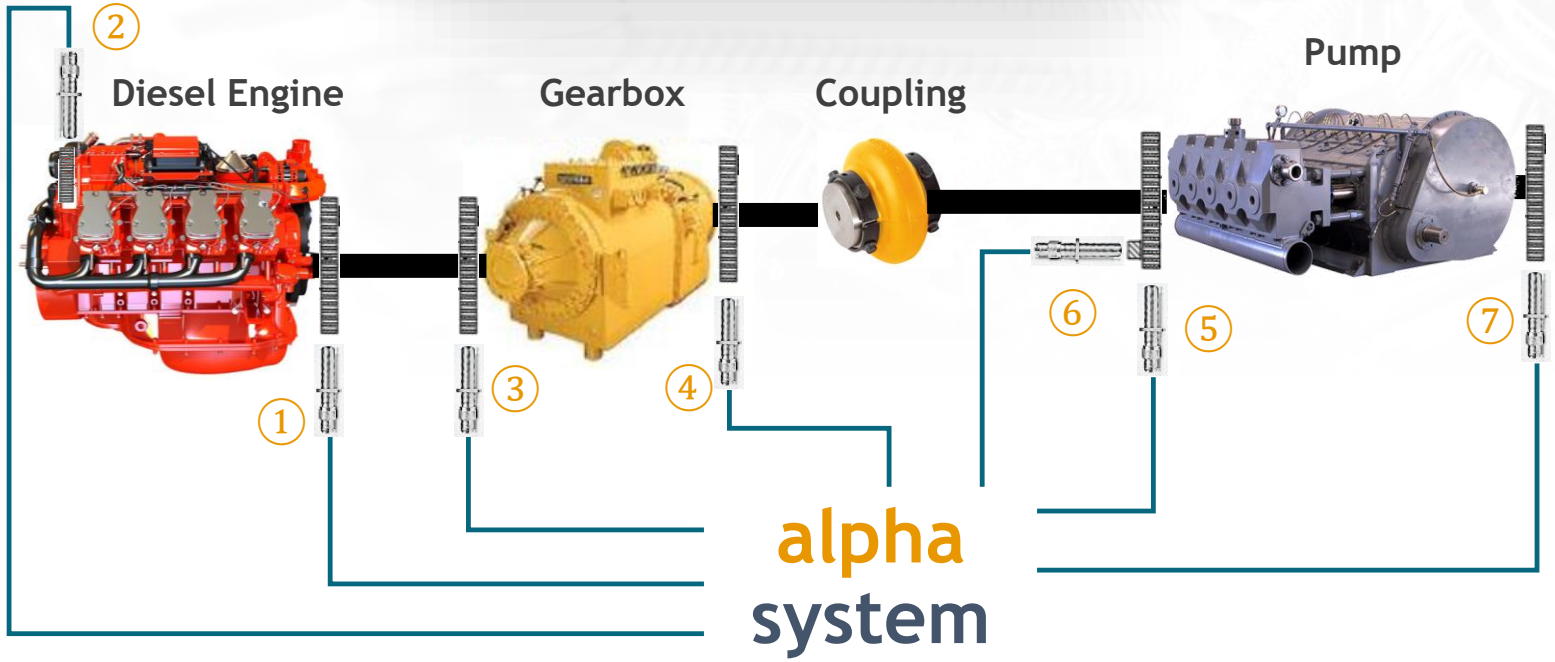
Wind Turbine Application

Function	Sensor
Torque Measurement	①②
Turbine Analysis	①
Turbine Bearing Analysis	①
Generator Diagnosis	④
Coupling (mech condition)	③④
Gearbox Diagnosis	②③



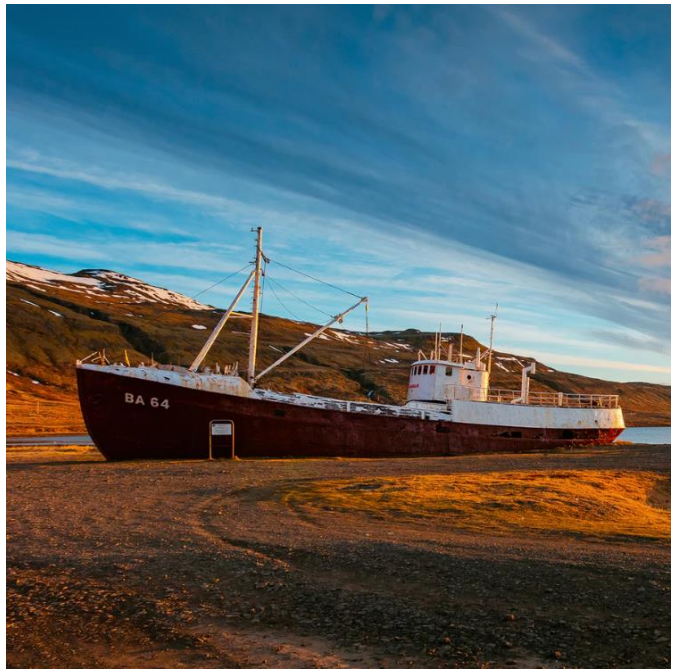
Frac Truck Pump Application





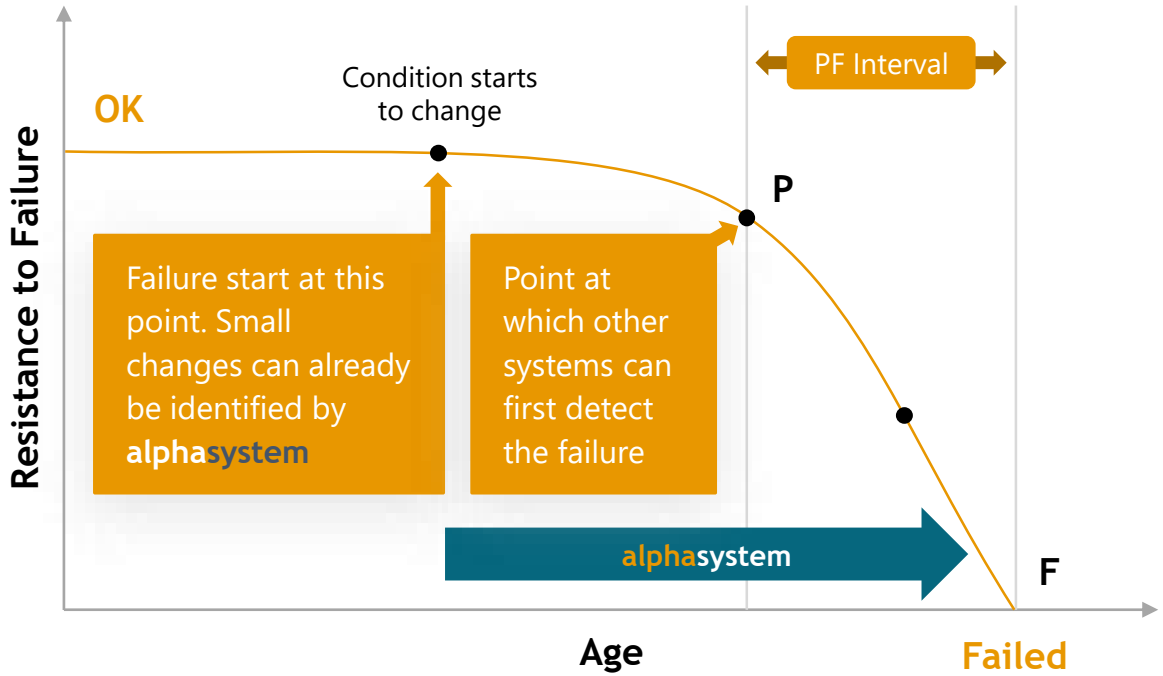
Function	Sensor
Diesel Engine Diagnosis	①②
Gearbox Diagnosis	③④
Coupling (mech. condition)	④⑤
Pump Diagnosis	⑤⑥
Pump Torque	⑤⑦

Business Models & ROI



Predictive Diagnostic Systems

- The predictive maintenance market is increasing by 20-30% every year*
- Advantages of predictive diagnostic systems
  - Increase life time
  - Huge cost saving on maintenance
  - Avoid unnecessary shutdown
  - Efficiency increases
  - Proper usage of resources
  - Reduce energy cost
  - Reliability of machines



https://www.iottechnews.com/news/2016/sep/07/importance-predictive-maintenance-iot-diagnostics

https://www2.deloitte.com/insights/us/en/focus/industry-4-0/using-predictive-technologies-for-asset-maintenance.html

Return on Investment (ROI)

Injectors:

- Many customers have to replace their injectors every 18 months. With the help of **alphasystem**, only faulty injectors are replaced:
  - Overall costs to change one injector: approx. $1000
  - Assumption: Replacement of 6 injectors in good condition
  - ➔ Unnecessary costs of $6000 -> ROI within 2-3 years

Overhaul of the complete engine:

- Rough cost is around $100K-150K
- **alphasystem** can extend complete overhaul of engine by approx. 50% more than normal operation hours -> extension from 20K hrs to 30K hrs ->ROI within less than 1 year

Axle Bearing:

- A damaged axle bearing in a bogie during operation costs approx. $40K (including replacement bus service, train for towing away defect train, customer dissatisfaction, etc.)
- **alphabearing** can avoid these expenses and increases customer satisfaction.
- ROI within one avoided damage of bogie axle bearings

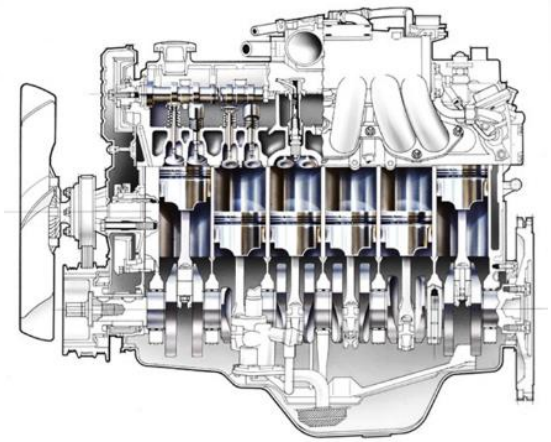
Business Models

Fleet Management:

- Each asset is diagnosed with an **alphasystem** and connected to **alphacloud**. This helps to keep an eye on the assets by continuously monitoring and reporting the health of the assets to avoid major and cost effective damage.

Rental Agreement:

- Same as fleet management but on monthly rental basis. Buyout option available after termination of rental period.



Service Based:

- Alpha Diagnostics provides a service. This includes a visit to the customer site to perform an analysis of the asset to be checked, providing a detailed expert report showing the health of the asset and recommending the next steps regarding maintenance.

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Example for Fleet Management

Urgent and Direct Communication

Detailed Report

Regular Reporting for Every Asset

Fault Code Generated

Fault Code Transmitted

Reports Stored

Customer Notification

Why alphasystem?

- Cost effective solution
- User-friendly
- Easy to use – quick to install
- No need to open machine for routing checks
- Robust & reliable
- Uncomplicated reports with detailed information (what to fix)
- Local and remote access – on-line - 24/7
- Management concept for a full fleet
- Essential tool for predictive diagnostics
- ROI in less than 6 months
- Huge savings on maintenance
- Increased efficiency of manpower

THANK YOU

for your attention

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