

Konditionsövervakning av roterande maskiner

Tomas Tibbling

Bently Nevada - GE Digital Solutions



imagination at work

Råmaterial
Energi



Maskiner



Produktion



imagination at work

Drift

Kondition/hälsa

Råmaterial



Maskiner



Produktion



imagination at work

Akut sjuk

Krasslig

Drift

Hälsa

Dolda problem

Friskvård

Råmaterial

Maskiner

Produktion



imagination at work

Drift

Avgörande med rätt givare och instrumentering

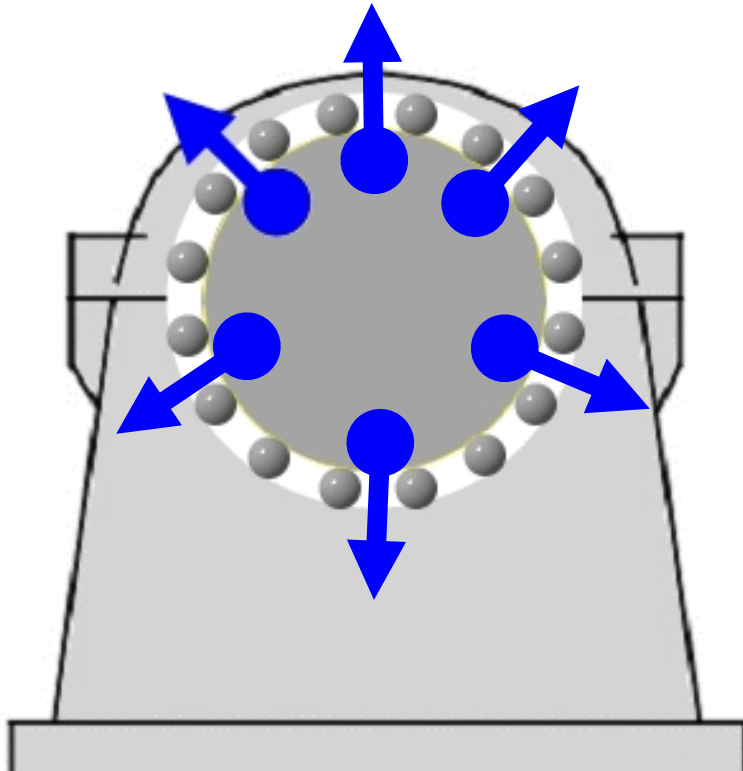
Varje givare ska ha klarlagd uppgift hur och varför den skyddar maskinen



imagination at work

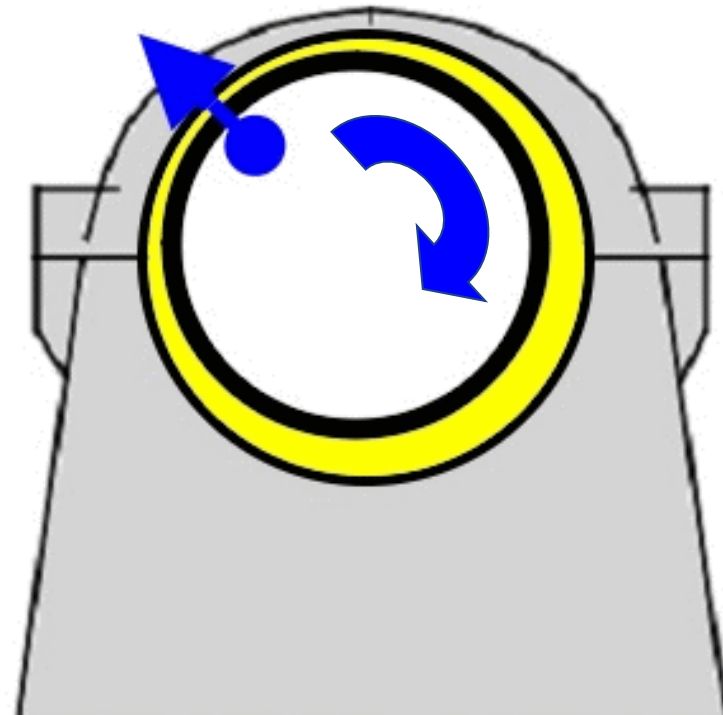
Transducers application

Case mounted transducers (Seismic)



Rolling Element Bearings

Proximity probes



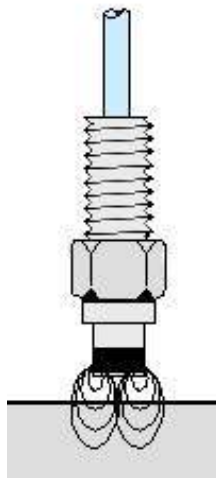
Fluid Film Bearings

Displacement

Physical Parameters

Definition

- Displacement is the change in distance or position of an object relative to a reference.



Eddy-current
proximity probe

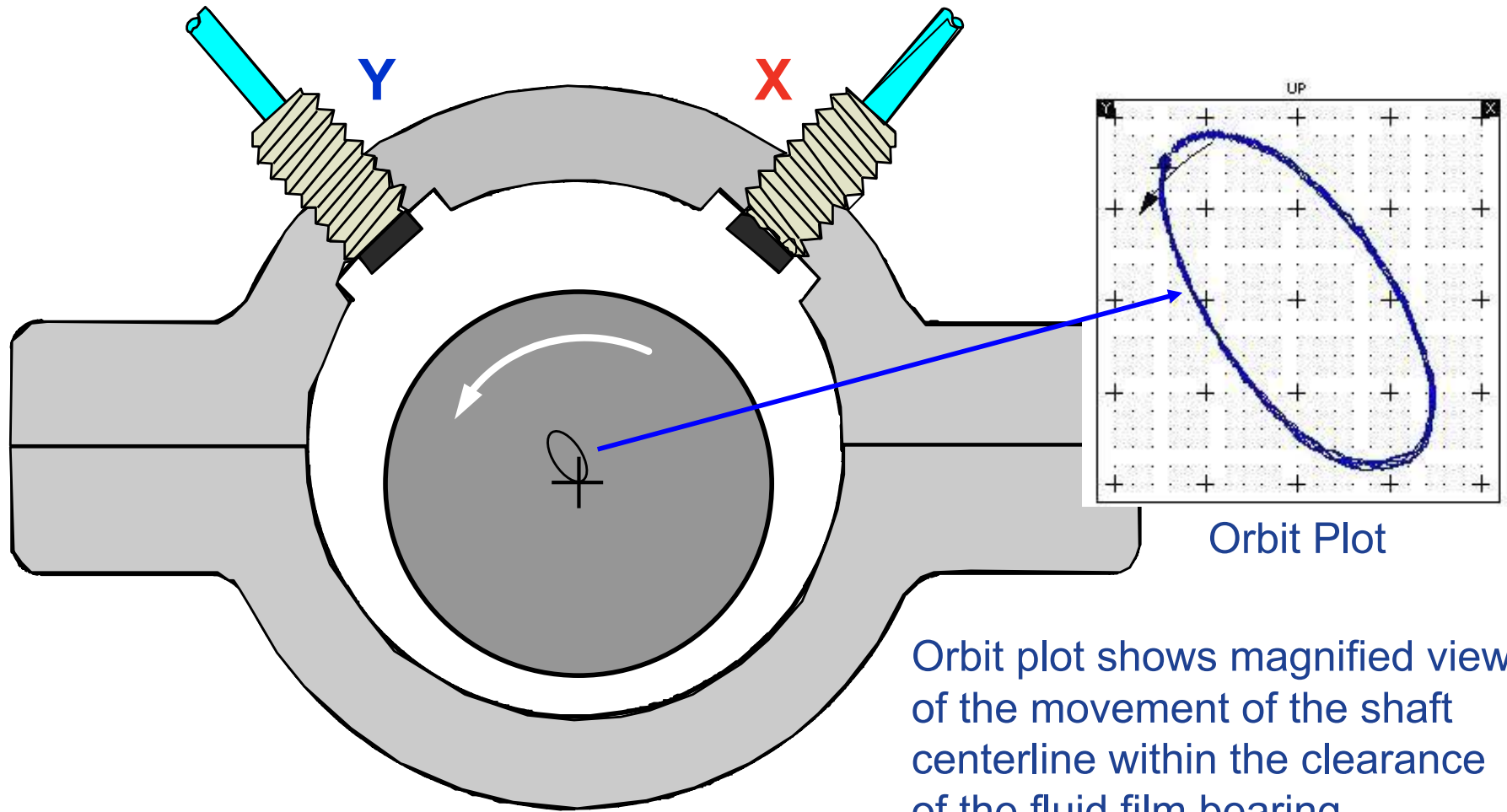
Typical Application

- Measuring rotor position within the clearance of fluid film bearings.
- Capable of low frequency response (down to 0 Hz).
- Units: microns (μm) or thousandths of an inch (mil)



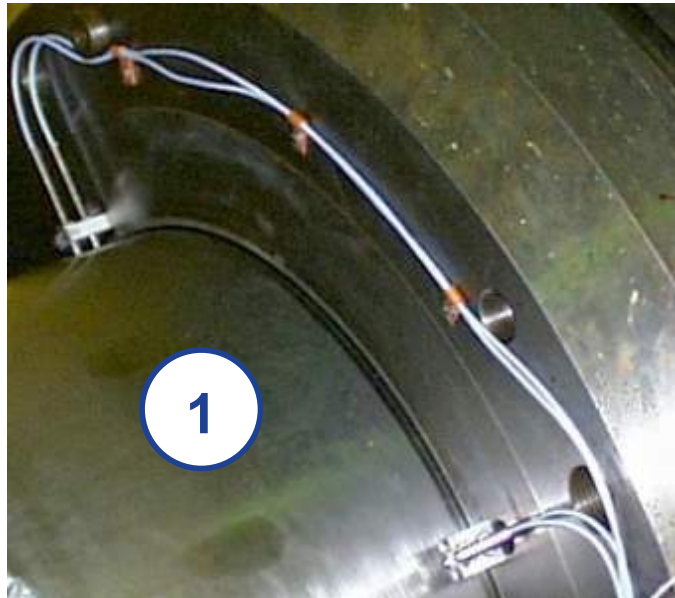
imagination at work

Radial (XY) Transducers



Radial Vibration

Example Internal Installations



Bracket-Mounted
Redundant Probes



Bracket-Mounted Single Probes



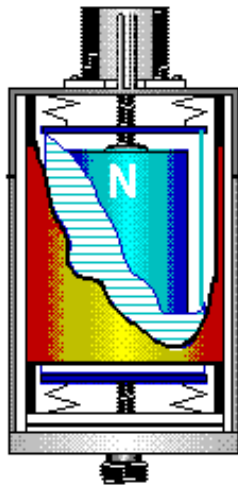
Bearing-Mounted Single Probes

Velocity

Physical Parameters

Definition

- Velocity is the time rate of change of the displacement of an object.



Moving-coil
sensor



imagination at work



Piezoelectric
(crystal)
sensor

Typical Application

- Measuring vibration of machine casing and other structural response characteristics.
- Useful for medium frequencies (~ 10 Hz to 10,000 Hz).
- Units: millimeters per second (mm/s) or inches per second (ips).

Acceleration

Physical Parameters

Definition

- Acceleration is the time rate of change of an object's velocity.

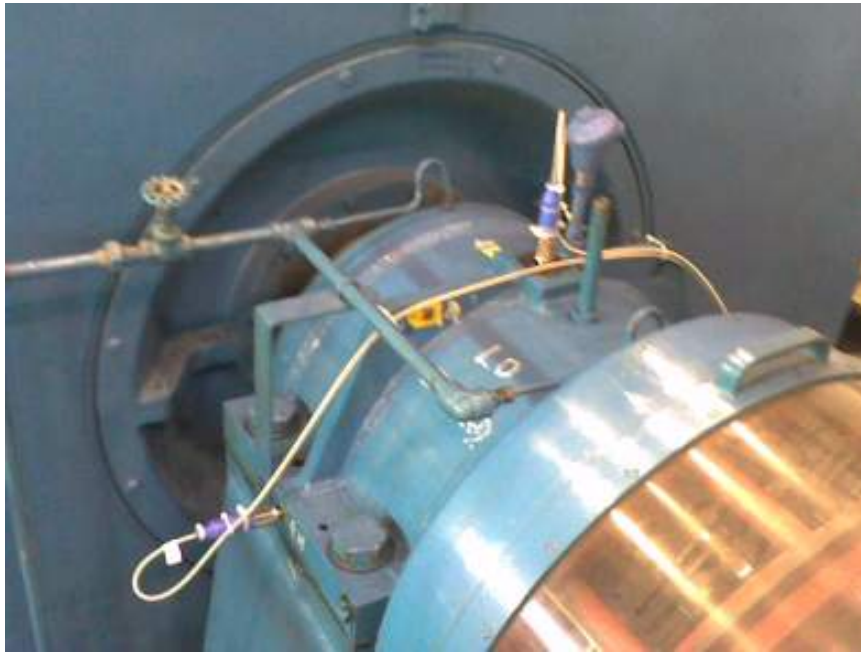


Piezoelectric
sensor

Typical Application

- Measuring high frequency vibration of gear mesh, rolling element bearing defects, etc.
- Capable of high frequency response (up to ~20 kHz).
- Units: meters per second² (m/s²), inches per second² (in/s²), or Standard Gravity (g).

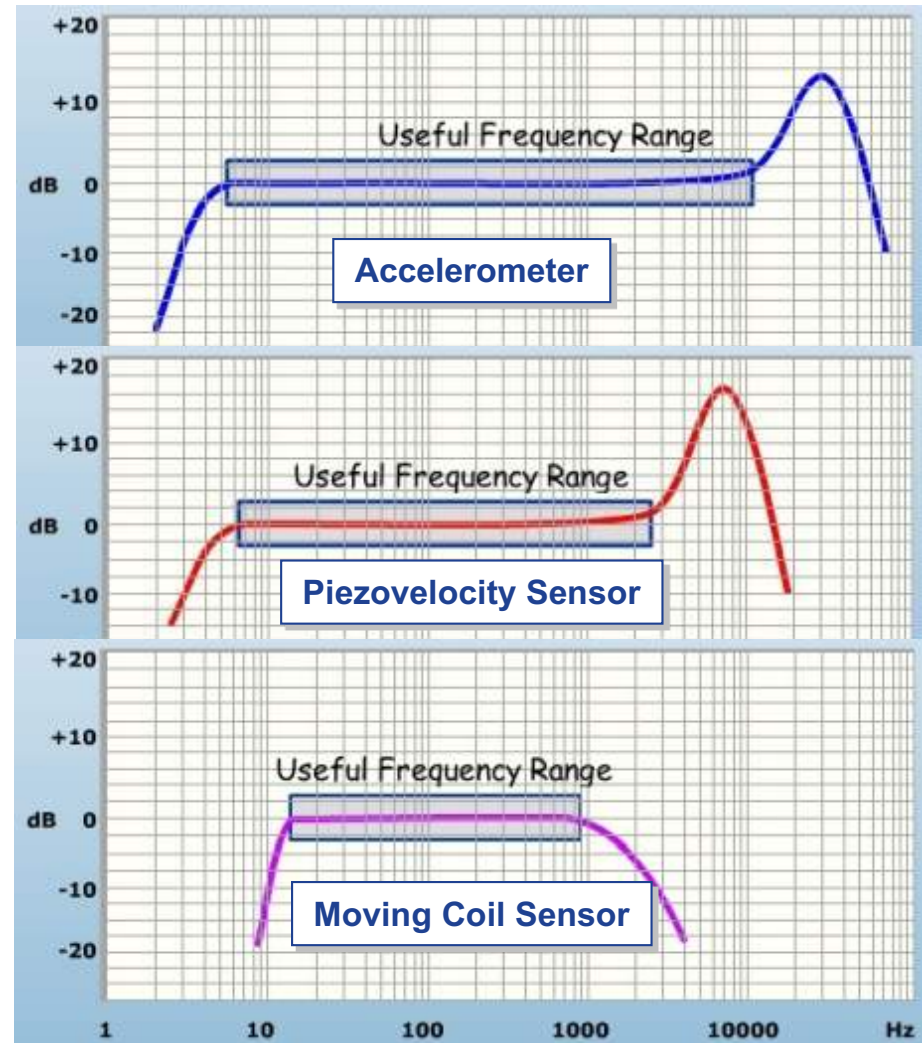
Velocity Transducers



Typical Frequency Ranges

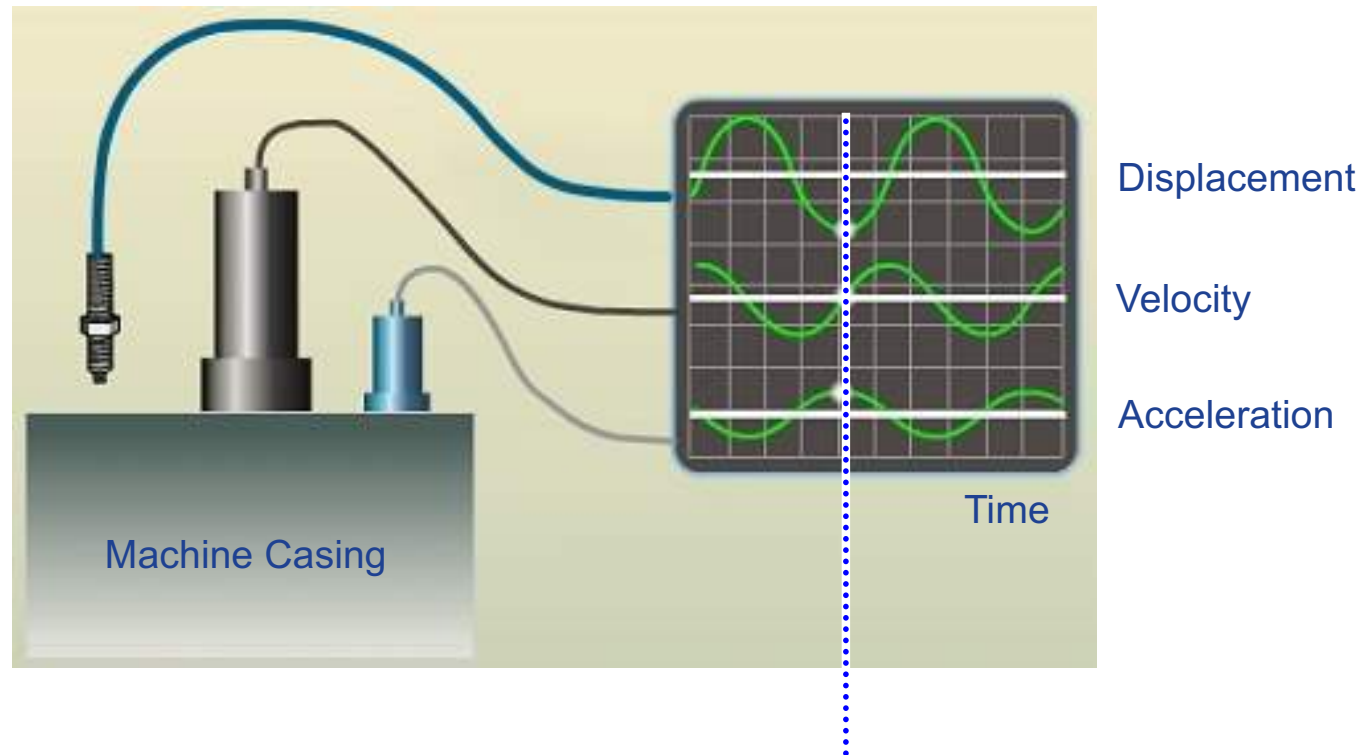
Seismic Transducer Basics

- **Accelerometer:** Highest frequency response. Used for gear mesh, impulse and other high frequency applications.
- **Piezovelocidity Sensor:** Lower high frequency response, but less noise than using an external integrating amplifier with an accelerometer.
- **Moving Coil Sensor:** More limited frequency response, but has no requirement for an external power supply.



Relationships between various Vibration Signals

Physical Parameters

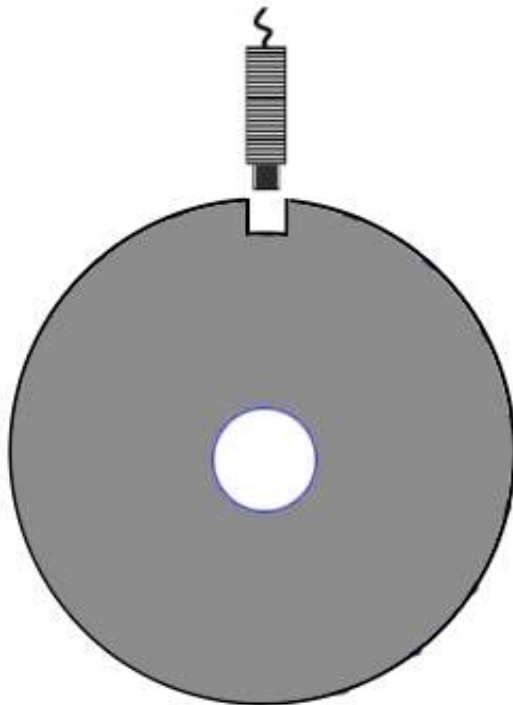


Displacement, velocity and acceleration measurements are “out of step” with each other.

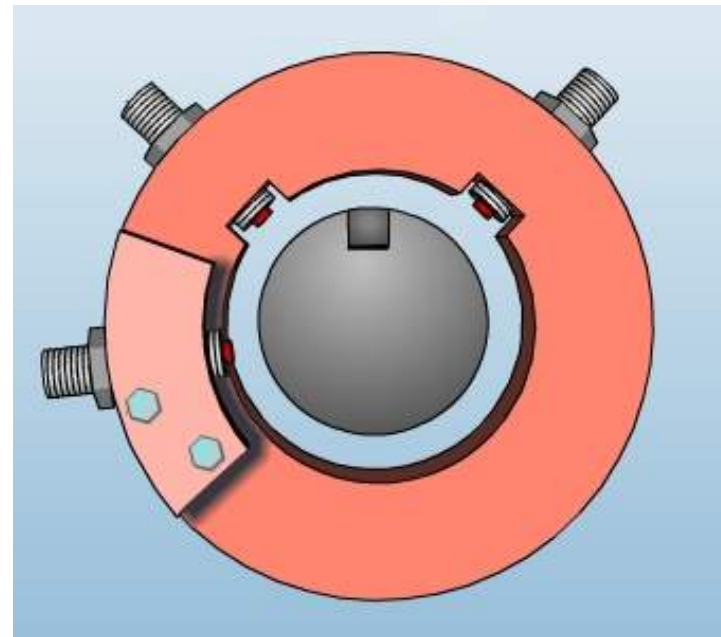
- Displacement = maximum (- direction)
- Velocity = zero
- Acceleration = maximum (+ direction)

Keyphasor[®] Transducer

Phase Angle



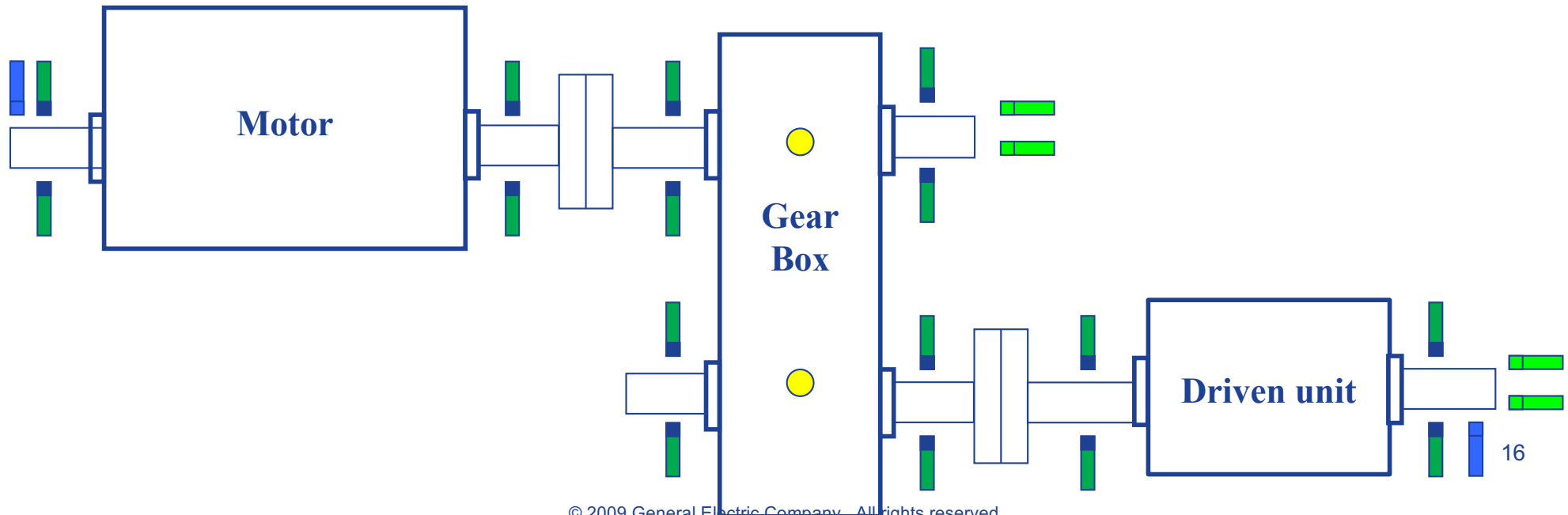
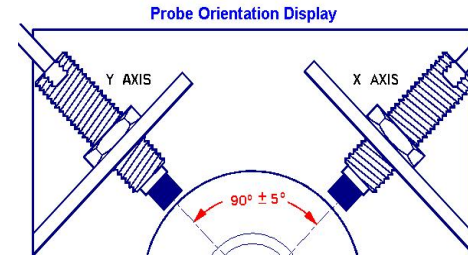
Keyway Notch or Projection



Typical Probe Installation

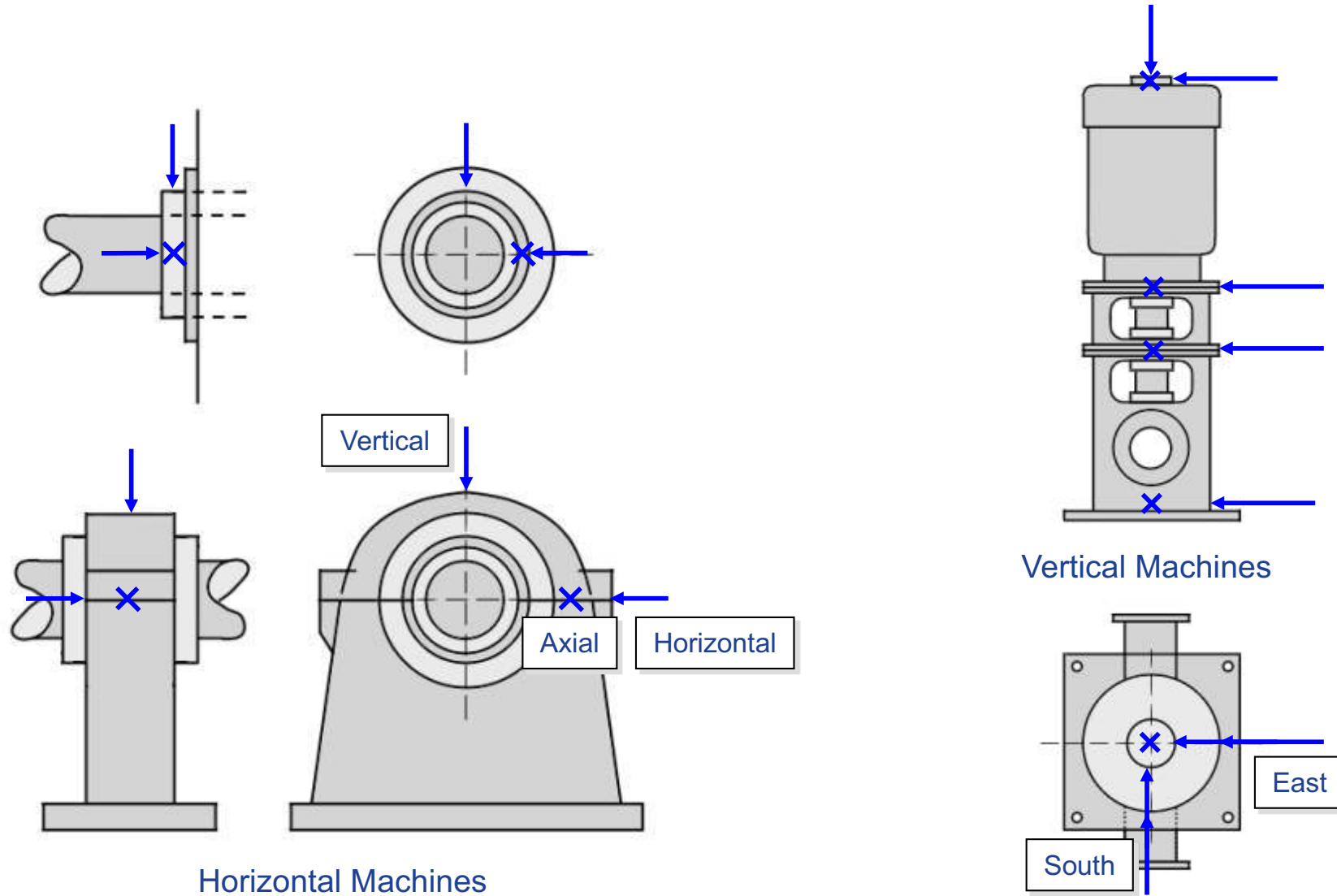
Givarplacering

- Keyphasor (rpm & phase)
- Radiell Vibration
- Axial Position
- Accelerometer (casing vibration, gear mesh)



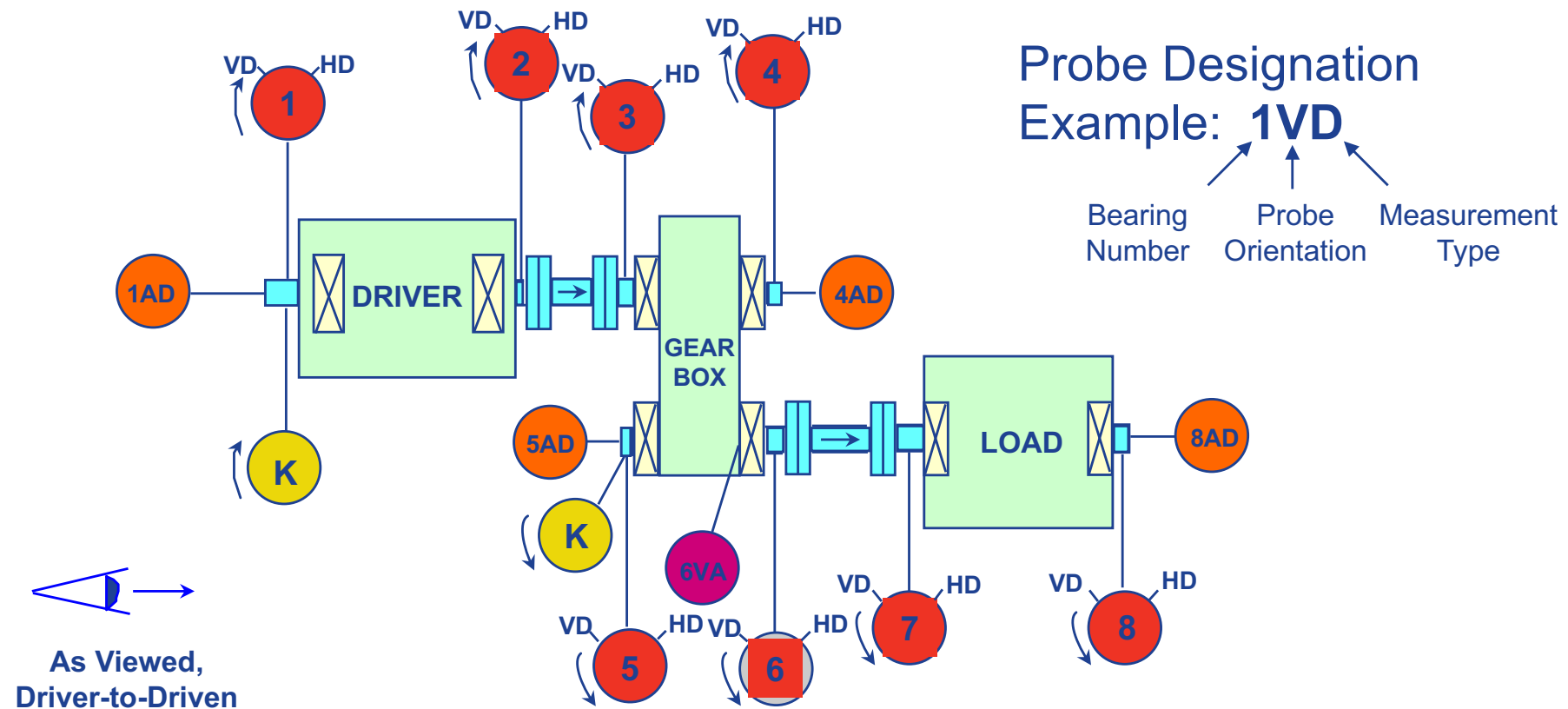
Transducer Positioning Example

Installation Guidelines



Machine Train Diagram

General Installation Guidelines



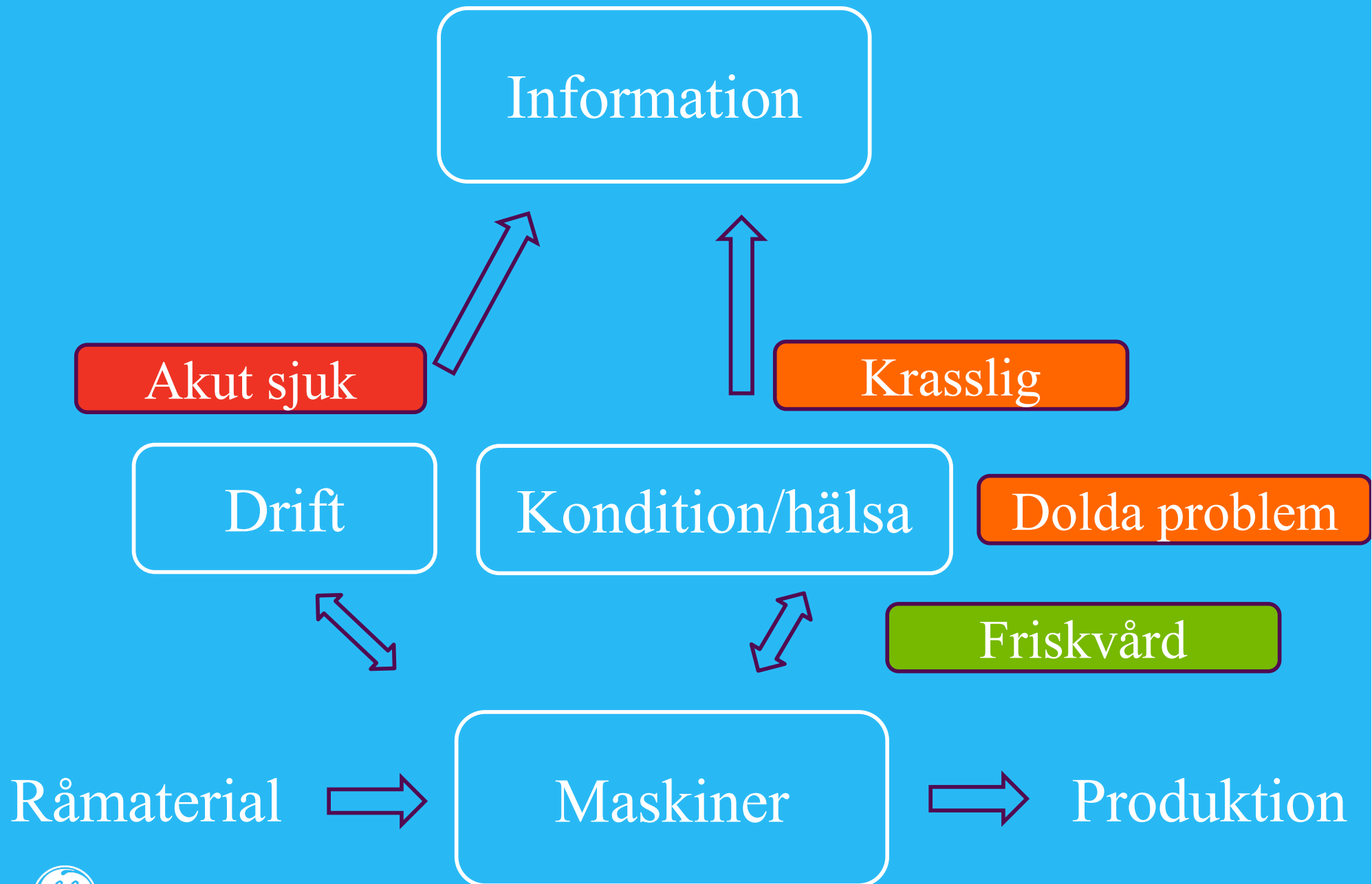
Orientation	Measurement
A = Axial	D = Displacement
H = Horizontal	V = Velocity
V = Vertical	A = Acceleration

Kondition/hälsa

Givarval inte lika kritiskt, men avgörande vem och hur man tolkar informationen från givarna.

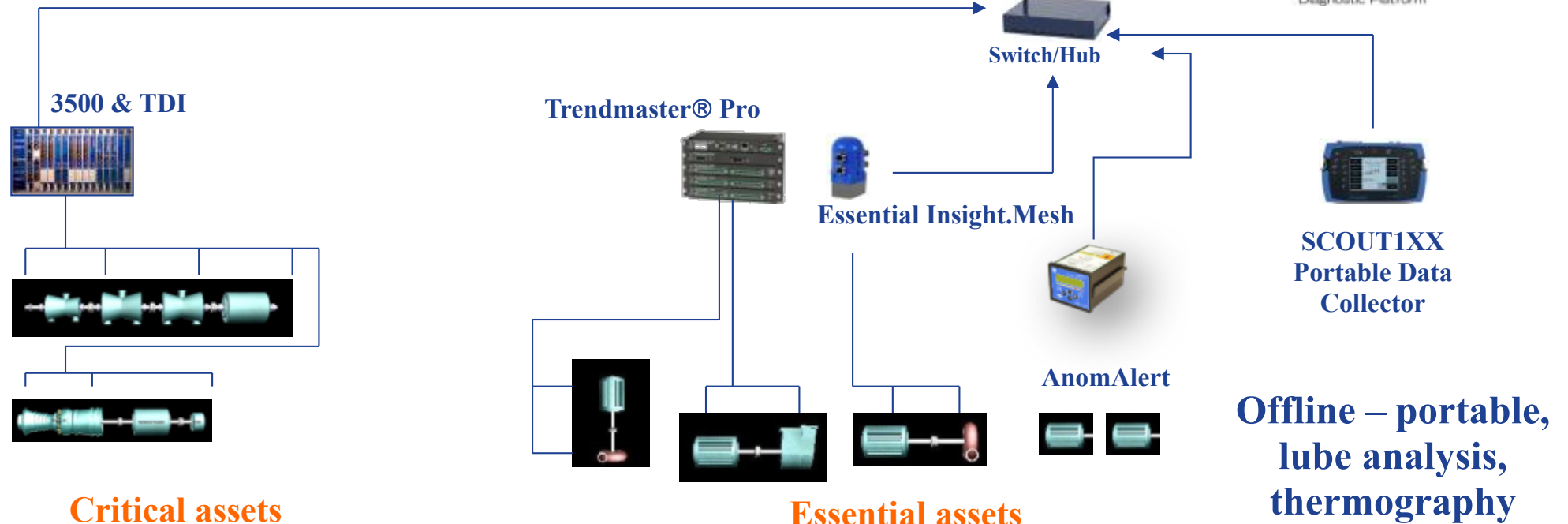


imagination at work



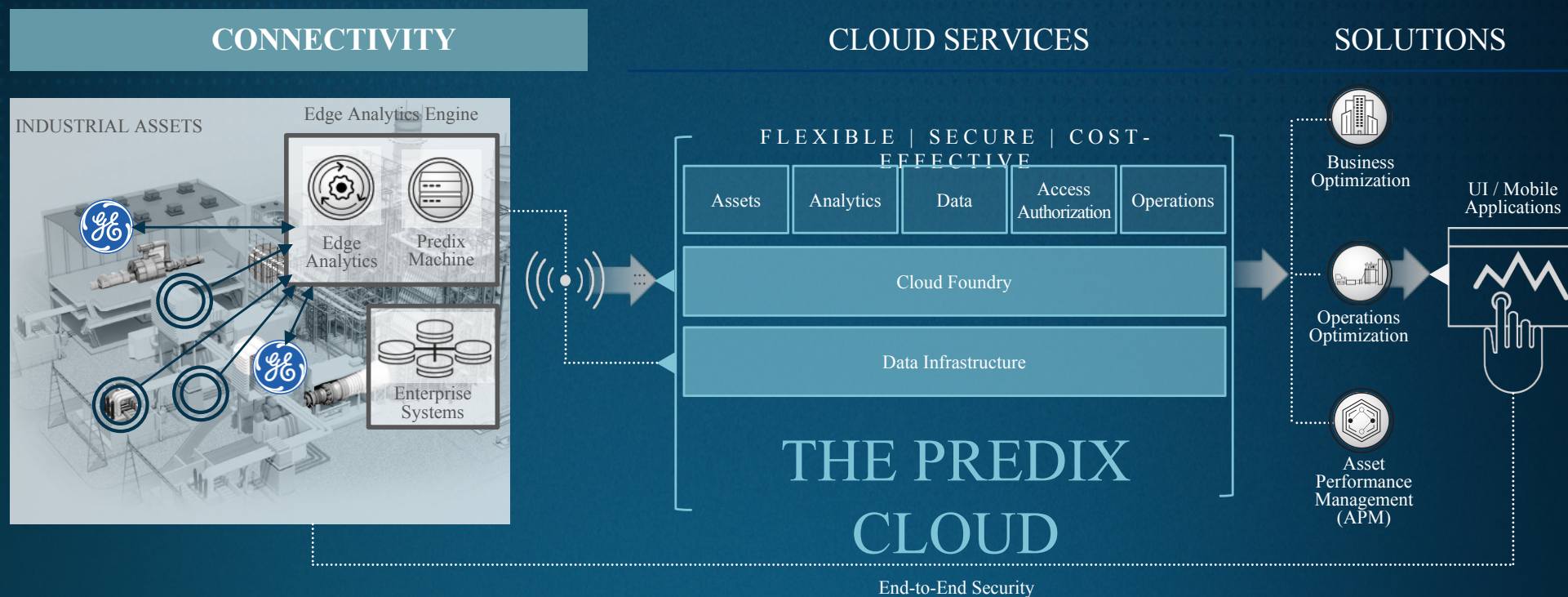
Online - continuous monitoring & protection

Online – periodic (scanning/wireless) monitoring



PREDIX – Industrial cloud-based platform

The Predix cloud connects all of the data collected from your industrial assets.



Machinery Diagnostic Services

Tolkar informationen och ger beslutsstöd till anläggningen för

- Fortsatt drift
- Återstart
- Planlagt underhåll
- Akut underhåll
- Stopp



Exempel Söderenergi

- Kontinuerlig övervakning av deras ångturbin och generator
- Veckovis kontroll
- Åtgärder och återkoppling vid larm
- Kontakt vid behov
- Kvartalsvis analysrapport
- Genomgång på plats

Över säkra, certifierade,
lösningar.



Information

Infrastruktur

Nätverk

- Lokalt/Öppet
- Säkerhet

Mjukvara

- Operativsystem
- Programvara

Server

- Lokal server
- Virtuellt server
- Molnbaserad
- Ägare av data

Kommunikation

- Telefon, SMS
- Email
- CD/DVD
- Portal

Analys, Beslut & Support

Analys

- Lokal kompetens
- Extern kompetens
- Rytme

Beslut

- Process
- Beslutsstöd

Support

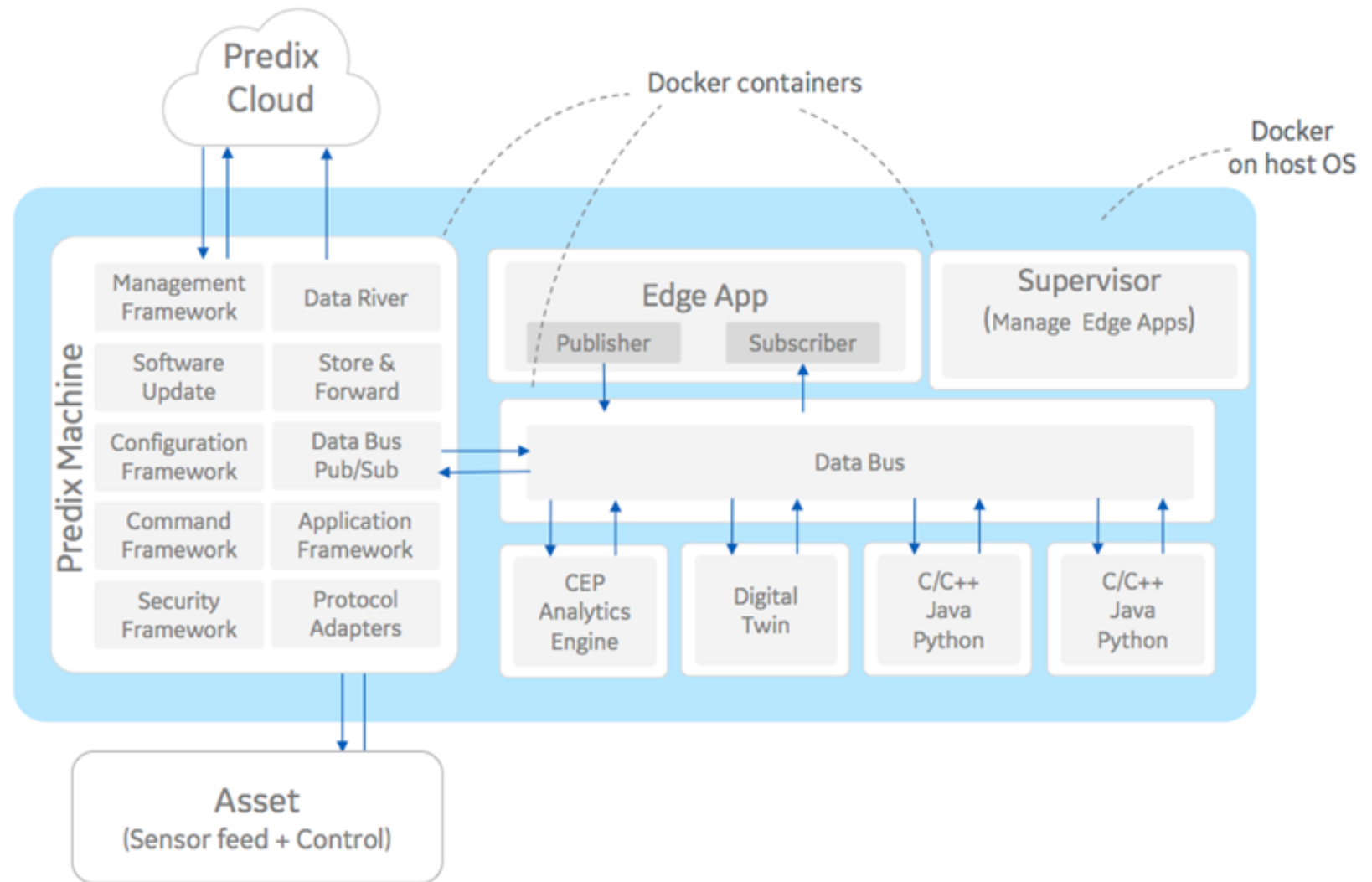
- Systemgenomgång
- Hälsokontroll
- Rådgivning
- Optimering
- Rytme



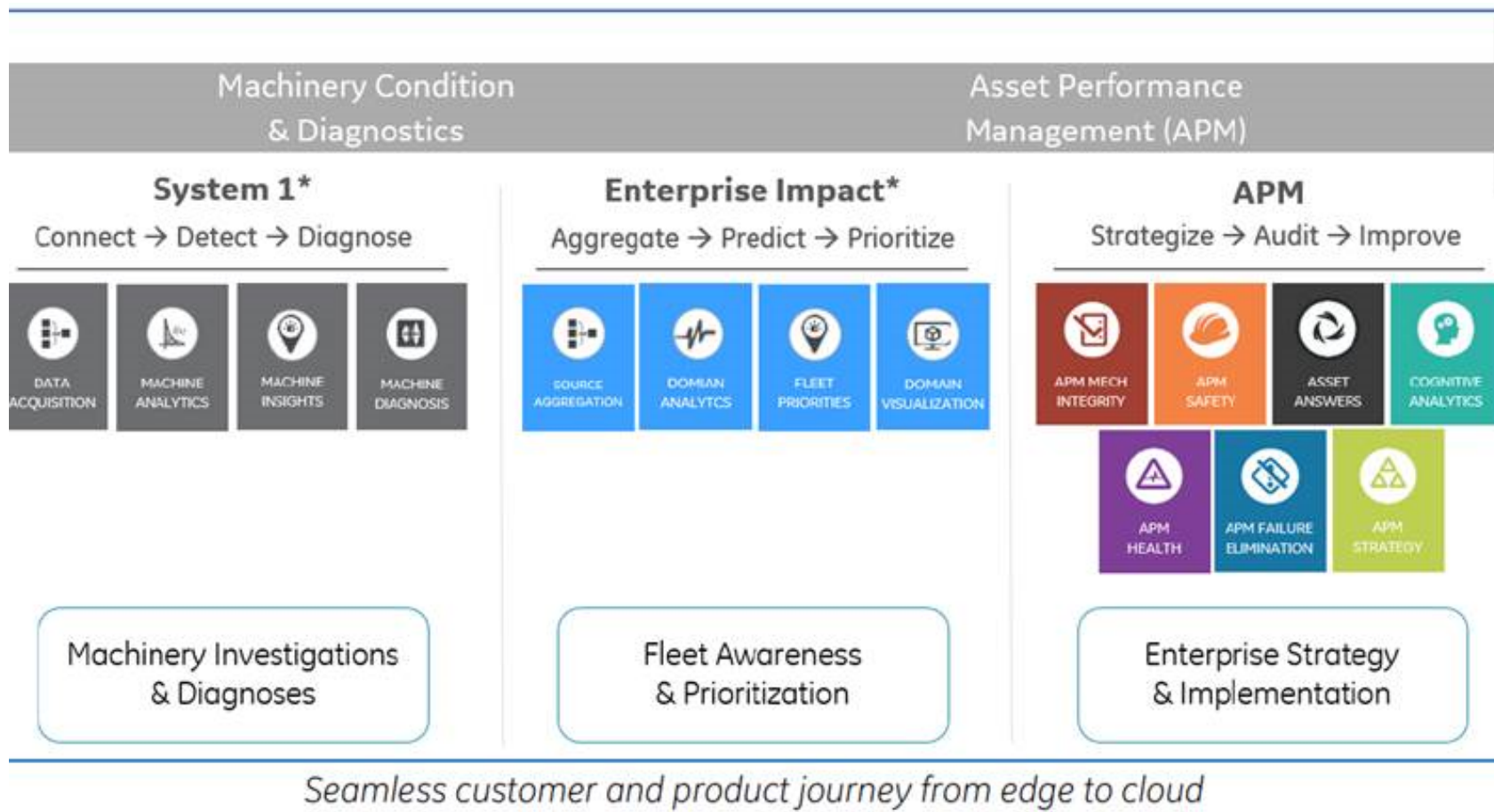
Backup slides



Predix Machine Architecture



imagination at work



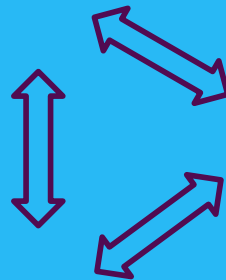
Upplägg

Investering

- Datainsamling
- Lokal Server & Mjukvara
- Nätverk
- Extra givare

Kontrakt - utrustning

- Datainsamling
- Server & Mjukvara
- Nätverk



Kontrakt - tjänster

- Systemgenomgång
- Hälsokontroll
- Analys & Rådgivning
- Optimering

