ABB Ability™ Smart Sensor
Motors that let you know when it's time for a service
What ABB Motors and Generators stands for

Our vision

We are to be the best supplier of industrial electric motors, generators and mechanical power transmission products, as determined by our customers.

With expertise, and a comprehensive portfolio of products and life-cycle services, we help value-minded industrial customers improve their energy efficiency and productivity.
Business Unit Motors and Generators in a nutshell

Serving a market of roughly 50 billion

What (Offering)

To whom (Customers)

Where (Geographies)

LV - Motors - MV Gen MPT

OEM Distributors EPC / SI / EU

AMC EUC AMA

> 3.5 Billion in revenue

~14,000 Employees in >80 countries

31 Manufacturing sites across all regions

65 Countries
Industrial markets primed to adopt digital technologies

Computing + connectivity + cloud + analytics set to unlock value
ABB Ability™

Industry-leading digital solutions built on a common set of standard technologies

- Open access, intelligent cloud
- New end-to-end digital solutions
- Systems to master process control
- Closing the loop with connected devices
ABB Ability™ Value Creation
Differentiate, boost your IoT strategy and your service business

- **Safety** - Improve safety at work with maintenance inspections from a distance
- **Reliability** – Reduce downtime by up to 70% with a transition from reactive to proactive maintenance
- **Energy Savings** - Save up to 10% energy in a plant with data from all encompassing energy audits
- **Maintenance Savings** - Save time and effort of maintenance engineers with early warning systems
- **Net Working Capital** – Equipment can live up to 30% longer with less redundant plant and spare inventory
- **Risk Mitigation** – Minimise your liabilities, such as warranty, uptime guarantee, transportation damage, etc.

The Internet of Things is much more than condition monitoring
ABB Ability™ Smart Sensor

Motors enter the digital age

- The sensor takes a measurement every hour, and has a memory for a month.
- Within that month the data is collected, either manually with a smart phone or automatically via a gateway.
- The data is analyzed by the powerful algorithms of ABB, the world's leading manufacturer of electric motors.

- ABB Ability Smart Sensor is like a fitness wristband for electric motors.
- Fit it easily to the surface of a motor, without wiring or machining, and collect operational data and health information of the motor.
- Maintenance and operation can be optimized in a way that was not possible before.
- The benefits can be significant, payback time expected to be less than one year in most cases.
- With IoT-technology the sensor performs at a low cost that was unthinkable a few years ago.
**ABB Ability™ Smart Sensor**

Three elements: Hardware, Apps, Web portal

<table>
<thead>
<tr>
<th>Hardware kit (for field upgrade)</th>
<th>Smartphone apps</th>
<th>Web portal</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sensor</td>
<td>• Sensor / motor registration</td>
<td>• User registration</td>
</tr>
<tr>
<td>• Bracket</td>
<td>• Health traffic lights</td>
<td>• User group management</td>
</tr>
<tr>
<td>• Sensor mount</td>
<td>• Latest operational data</td>
<td>• Settings for alert and alarm</td>
</tr>
<tr>
<td>• Adhesive putty</td>
<td></td>
<td>• Support</td>
</tr>
<tr>
<td>• Three screws</td>
<td></td>
<td>• Historical data</td>
</tr>
<tr>
<td>• Quick Start Guide</td>
<td></td>
<td>• Health parameters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Operational parameters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Trending</td>
</tr>
</tbody>
</table>

©ABB
October 23, 2017 | Slide 8
ABB Ability™ Smart Sensor
Monitoring and maintenance of LV motors

The fourth industrial revolution
ABB Ability Smart Sensor does not do anything we could not do before - it just does it more easily and cheaply.
Most motors can get good monitoring for the first time with the ABB Ability Smart Sensor.

- Safe remote monitoring
- Proactive maintenance
- Fleet analytics
- Risk mitigation, e.g. warranty, uptime, transportation, etc.

Use your Smart Sensors on
- old motors and new
- small motors and large
- ABB motors and non-ABB
ABB Ability™ Smart Sensor

What would a fitness wristband measure on a motor?

Motor health manifests as:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearings condition</td>
<td>e.g. lubrication issues, damaged elements</td>
</tr>
<tr>
<td>Cooling condition</td>
<td>e.g. dirty fan cover</td>
</tr>
<tr>
<td>Rotor condition</td>
<td>e.g. cracked bars or short circuit rings</td>
</tr>
<tr>
<td>Airgap condition</td>
<td>e.g. eccentricity, bent shaft, soft feet</td>
</tr>
</tbody>
</table>

Motor activity shows as:

<table>
<thead>
<tr>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumption</td>
</tr>
<tr>
<td>Vibration levels</td>
</tr>
<tr>
<td>Temperature</td>
</tr>
<tr>
<td>Operating hours</td>
</tr>
</tbody>
</table>

©ABB
October 23, 2017   |   Slide 10
Cloud-based ABB Ability™ platform proprietary, patented ABB Software User portal

Customer's cloud and connected systems

Smart phone or gateway

Sensors on assets

Service engineer

User web portal

Cloud

Site
Imagine owning a fan and motor mounted in the ceiling…

**Without sensor**

Nobody ever goes near that motor.
You will be surprised when it fails, then you will:
- Pull the spare motor out of your warehouse
- Find an electrician and beg her to come
- Get the mobile lift in place
It will take at least one day to replace, even if you have a spare in stock.
If the process or the driven equipment was damaged by the unexpected motor failure, all times and cost can be multiplied by ten.

**With sensor**

Nobody ever goes near that motor.
You will get a warning in your Smart Sensor app before anything has happened, then you will:
- Order a new motor from your nearest ABB Value Provider
- Book the mobile lift for Tuesday
- Technician comes Tuesday with motor
- Process run down and run up in an orderly fashion
Within two hours it is replaced.
Without a spare motor in stock and without an electrician on standby.
Thank you for your attention

Wrap-up

Affordable, clever and easy solutions

- Improve safety
- Reduce downtime
- Save energy
- Reduce maintenance cost
- Optimize investment
- Mitigate risk
- Grow digital business
- Grow service business
Imagine being a machinery OEM, looking to grow your business beyond product sales…

**Without sensor**
You manufacture machinery, package it with motors from ABB and others, and sell it.

**With sensor, as before plus…**
Smart Sensors are fitted on all the motors you sell. Your machinery gets fitted with sensors provided by yourself or by ABB.

App, web portal, backend, user management is provided by ABB as part of the contract.

Your sensors are connected to the same cloud, and your deep domain competence is added to the analytic algorithms in the backend.

You use your new IoT offering to grow your service business, or to build new revenue streams.

You get all data into your own system via a cloud interface.

Everything is also available as your retrofit offering.
Imagine that you are a service provider with motors under contract…

<table>
<thead>
<tr>
<th>Without sensor in your portfolio</th>
<th>With sensor in your portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover 5 end-user sites with the team you have.</td>
<td>Cover 10 end-user sites with the team you have.</td>
</tr>
<tr>
<td>Take care of the reactive maintenance.</td>
<td>Introduce proactive maintenance.</td>
</tr>
<tr>
<td>Repair when something breaks down.</td>
<td>Make your customer happy because they have less downtime and lower cost than before.</td>
</tr>
<tr>
<td>Tell your customer you’re working as fast as you can.</td>
<td>Help your customer to save energy, and sell some drives and new motors in the process.</td>
</tr>
<tr>
<td></td>
<td>Help your customer avoid accidents.</td>
</tr>
<tr>
<td></td>
<td>Reduce your own inventory of spare motors.</td>
</tr>
<tr>
<td></td>
<td>Mitigate the risk when you have to give guarantees or promise something.</td>
</tr>
<tr>
<td></td>
<td>Buy your subscription from ABB and sell subscriptions to your clients.</td>
</tr>
<tr>
<td></td>
<td>Sleep until late on Sundays, because you don’t have an urgent breakdown Saturday night.</td>
</tr>
</tbody>
</table>
Imagine being a pump manufacturer, worried about warranty risk and transportation damage...

**Without sensor**

You sell a package of pump and motor.
The package is delivered to your customer.
You have previously experienced rough handling during transportation, and are always a bit worried about the rotational seals.
You have experienced customers who handled the equipment badly and then claimed a warranty defect when it broke down.

**With sensor, as before plus...**

The sensor is taking measurements every hour from the moment the package leaves your factory.
During transportation the sensor will monitor the treatment. After arrival you can check if the forwarder dropped the crate.
After commissioning the sensor will keep collecting data even without a cloud connection, and if there is any warranty investigation you can access the operational data several months back.
If the end user’s maintenance team want to use the sensor, then they can activate a subscription with ABB. If your contract with ABB is set up accordingly you might get a share of the revenues and the data that is collected.
Imagine being a commodity manager for a global corporation, leaving operational decisions to the production managers on site...

**Without sensor**
Sign a frame agreement with ABB for delivery of the best LV motors and drives in the world.

**With sensor**
Amend your frame agreement with ABB, to include smart sensors on all motors.
Motors arrive to the different sites with inactive smart sensors.
The plant managers decide which motors he wants to monitor, and then activates the matching sensors with his smartphone.
Subscription fee for active sensors are charged to the plant. No fee for inactive sensors.
Run trials in one plant, document entire experience. Spread the outcome of the trial as best practice.
The sensor mount is permanently installed between the cooling ribs of the motor with adhesive putty (Henkel Loctite 3463). Initially 5 sizes are available.

**UNF 1/4"-28** mechanical interface is "future proof" for possible upcoming ABB Ability™ Smart Sensor of different design.

No electrical wiring required / possible.

The MEMS Multi-Sensor System inside the sensor is "future proof" for possible upcoming ABB Ability™ Smart Sensor of different design.

**UNF 1/4"-28** mechanical interface is "future proof" for possible upcoming ABB Ability™ Smart Sensor of different design.

No electrical wiring required / possible.

**Built-in batteries**

Not exchangeable

Design life 5 years, realistically 3-5 years

Firmware with FOTA (Firmware Over-The-Air, i.e. updates via smartphone or gateway)

Certified:

- **IP66**
- **CE**
- **Bluetooth**
- **FCC**
- **UL**
- **Class I, Div 2**
- **Intrinsically Safe ATEX**

*) certification still in progress

Range:

- theoretical max > 100 m
- realistic ~ 50 m
- industrial environment < 25 m

Sensor in flight mode at delivery
ABB Ability™ Smart Sensor

Screenshots from the web portal

The web portal shows the trends and past measurement.

Access rights and user privileges are managed via the web portal.