Customer presentation, PG Service, BU Motors and Generators

ABB MACHsense-R
Remote condition monitoring for motors and generators
ABB MACHsense-R
Overview

- Remote condition monitoring for motors and generators while operating
- Works on same platform as ABB MACHsense-P
- Sensors feed signals to Data Analysis Unit for processing
- On-board processor generates Key Condition Parameters (KCPs) for each potential fault
- KCPs are transmitted wirelessly to ABB server
- Customer can log in to ABB server and view overall status
- When KCP exceeds preset limits, alarm is triggered and sent to customer
- ABB local service center provides expert follow-up and detailed report
Measurements & Analysis made by DAU-Data Analysis Unit. The following signals are collected by DAU:

- Vibration
  - Data from 4 different vibration sensors are collected simultaneously

- Temperature
  - RTDs pre-installed in motor supplies temperature signals

- Current (optional)
  - Current clamps mounted in neutral terminal box of motor provides stator current information.
Sensor Mounting
Vibration Sensors

- DAU mounted on motor or at near by location
- Vibration sensors are mounted on:
  - Bearing location - Picks up mechanical related faults
  - On Motor body - Picks up electrical related faults
- Cable laid from sensors to DAU
Sensor Mounting
Temperature & Current signals

Temperature Cables
- Part of standard supply
- Outputs taken from Auxiliary terminal box of motor
- Cables will be laid to DAU

Current Sensor
- These are part of Optional accessory
- Sensors will be mounted on secondary side of CT in control panel
- Cable will have to be laid from control panel to DAU
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Configuration and set up

- Configuration by ABB field service engineer using ABB MACHsense-P to:
  - Relate Electrical Signals with that of Vibration

- For example:
  - Actual operating slip
  - Operating load
  - Operating speed and line frequency
  - Relationship between load and slip
  - Operating level of each KCP

- Set up generation of Key Condition Parameters (KCPs) for different faults

- Set alarm levels – alarm will be triggered when operating parameter exceeds preset limit
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Web based solution

- KCPs transmitted to ABB server through internet
  - Communication through 3G//GPRS
  - Wired communication possible incase of no coverage

- Secure ABB server manages data, provides online access to authorized customer personnel

- Server generates alarms – sent to customer by SMS or email
Key Condition Parameters

Trend of analyzed data

Operating Condition:
- Running speed
- Line frequency
- Slip(load)
- No of starts & stops

Rotor Condition:
- Rotor bar damage
- Dynamic eccentricity
- Static eccentricity
- Torque oscillation

Installation:
- Overall vibration
- Severity of vibration as per ISO 10816
- Amplitude & Phase at 1,2,3,4x rpm
- Temperature-Cooler fouling

Bearings:
- Likelihood ration analysis for anti friction bearing
- Separate analysis for sleeve bearings
ABB Solution
Rotor asymmetry

- Traditional measurements uses only current analysis
- ABB solution based on vibration using unique algorithms and analysis methods
- The following are identified from motor body vibration:
  - Line frequency
  - No of rotor bars
- From above following are calculated:
  - Actual operating slip-provides information on rotor bar damage
  - Eccentricity issues-no of rotor bar time rpm

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Tolerance</th>
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<tbody>
<tr>
<td>8 a)</td>
<td>Slip of induction motors (at full load and at working temperature)</td>
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<tr>
<td></td>
<td>$P_h &lt; 1 \text{ kW}$</td>
<td>$\leq 10$ % of the slip</td>
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<tr>
<td></td>
<td>$P_h \geq 1 \text{ kW}$</td>
<td>$\leq 20$ % of the slip</td>
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ABB Solution
Bearing Analysis

Anti Friction bearing
- Uses unique signal processing techniques such as adaptive filtering to reduce noise
- Applies demodulation and maximum likelihood analysis

Sleeve bearings
- Uses 3D plot based model analysis
- Model based on phase relation between sensors
- Plots orbit graph from accelerometer signals
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The Deliverables

**Standard offering**

- Key Condition Parameters (KCP) are generated indicating condition of:
  - Rotor
  - Bearing
  - Mechanical condition
  - Operating condition
  - Cooler

- 12 monthly summary reports per year

- 2 Detailed reports per year

- Web Based Monitoring
  - Trend monitoring
  - Alarm and alert notification

**Add-ons (Charged additionally)**

- Current analysis (MCSA)
- Detailed report for alarms
- Interface with automation system
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Benefits of ABB web based approach

- Avoids false alarms by monitoring KCP rather than overall values
- Monitors condition of each fault by trending KCP
- Keeps costs down by transmitting only KCPs rather than raw data
- Enables customer access to all information at any time via internet
- Allows detailed report to be generated when required
- Provides support at time of alarm generation with expert analysis and maintenance plan
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How does the service work?

- Customer
- RTC
- LSC
- KCPs

Plant
- Motors in Plant
- Sensors wired to DAU

DAU - Data Analysis Unit

Web Server

Wireless transmission to web server through internet

Data in web portal accessible via internet

KCPs

Alarm
Alert

Time
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What happens when there is an Alarm?

- Plant
- Motors in Plant
- Sensors wired to DAU
- DAU-Data Analysis Unit
- KCPs
- Wireless transmission to web server through internet
- Web Server
- Alarm notification through SMS, e-mail
- Customer
- LSC
- Detailed Report
- RTC
- Time
- Alarm
- Alert
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Target application

Wind Power
Process Industry
Off Shore
COG

Marine
Metal
Mining
Traction
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Advantages over conventional systems

- On-board analysis
  - Higher reliability and quantification of defect severity

- Data transfer via GPRS, 3G
  - No need to pass data through firewalls at customer site

- 4 channel vibration and 5 channel temperature data collection
  - Unique sensor mounting locations to pick up electrical and mechanical faults
  - Cross channel phase for trouble shooting

- Web based solution
  - Enables customer to view data from anywhere across the globe

- Alarm handling
  - Fast notification of alarm through SMS, e-mail
  - Prompt report submission on generation of alarm

- Automated analysis
  - Generates quick automated report
  - Applicable to wide range of motors and generators
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Clear customer benefits

- Continuous monitoring of motor or generator while operating - no unscheduled stoppages
- No complicated installation - wireless data transfer
- Provides early warning of failures – allows time to plan maintenance
- Transfers raw data only when threshold limit is exceeded - minimizes data transfer costs
- Automated report on motor condition - provides recommendations for corrective action
- No manual interference/monitoring required - minimize human error
- Unplanned downtime is reduced, resulting in optimized cost of ownership
Business Model
Customer Buying options

Customer Buying Options

Hardware & Service
- Customer buys hardware and enters into service contract with ABB
- Service contract is for minimum one year and maximum 3 years.

Only Service
- Hardware owned by ABB. Customer enters into service contract.
- 3 year service contract only is offered under this option.
Hardware & Service

Hardware:
- DAU-Data Analysis Unit- 1no
- Vibration accelerometers with 10mtrs cable- 4sets
- Temperature cables-4 sets
- 4GB SD Card-1no

Service
- 24x7 access to portal
- Trend of analyzed data
- 12 summary reports per year
- 2 detailed report per year
- Alarm notification
Power and productivity for a better world™