ABB Ability™ Condition Monitoring for switchgear

SWICOM: modular diagnostic unit for your assets
Short introduction

Current market and transition

Current Market

- Focus on switchgear, breakers and relays
- Minimum life of 30 years for primary equipment and 15 years for electronic equipment
- Robust with low failure rates
- Higher consequence in case of failure

ABB Ability™

ABB offers more with digital solutions:

- Sensing equipment on board
- Software based solutions
- Communication between different layers and tools

Electrical distribution digitalization: an ABB Ability™
Asset management
Find the optimum balance

Effective asset management
Effective asset management requires investment planning. The owners need to be aware of:

– Assets condition
– Risk level
– Failures consequences
– Life cycle status
– Retrofit investments

Optimal maintenance strategy
Asset health management

Maintenance strategies

1. Run to failure
2. Time-based
3. Usage-based
4. Condition-based
5. Predictive

Value and savings

Reduce labor costs by centralizing data collection and analysis

Value and savings at fingertips with advanced maintenance strategies
Choose a condition based maintenance solution
Reduce Opex, Maximize Uptime and Improve Safety

Transform preventive maintenance activities
By knowing real time asset health condition, manual inspection and preventive activities is not required. Perform maintenance when and where it is required.

Reduce probability of extraordinary events
Avoid extraordinary intervention through continuous supervision of the assets, which enable the possibility to plan the intervention in advance thus avoiding critical situation.

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Reduce total cost of ownership
Optimizing maintenance

<table>
<thead>
<tr>
<th>Asset type</th>
<th>SWAPs* level</th>
<th>Activities duration (h)</th>
<th>Activities duration with M&amp;D (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit breaker</td>
<td>Act</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Perform</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Switchgear</td>
<td>See/Watch</td>
<td>0.5</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Act</td>
<td>0.75</td>
<td>0.525</td>
</tr>
<tr>
<td></td>
<td>Perform</td>
<td>2.5</td>
<td>1.75</td>
</tr>
</tbody>
</table>

**Legenda**

<table>
<thead>
<tr>
<th>S</th>
<th>See/ Visual</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>Watch/ In-dept Inspection</td>
</tr>
<tr>
<td>A</td>
<td>Act/ Basic maintenance</td>
</tr>
<tr>
<td>P</td>
<td>Perform/ Advance maintenance</td>
</tr>
</tbody>
</table>

Reduction of unplanned labor cost maximizing uptime

- up to 40% Maintenance activities cost reduction
- 30% Reduction of time to do maintenance
- 30% Maintenance activities duration's reduction

**Standard conditions**

**Standard conditions with M&D**
Maximize uptime
Avoid unexpected failures

Before failure happen

– Digitalization informing before the system fails
– Know-how about the current asset
– Avoid possible failures help reduce production and asset loss

$1.2M PER HOUR*
AVERAGE DOWNTIME COSTS FOR AN AUTOMOTIVE INDUSTRY

$740k PER OUTAGE*
AVERAGE DOWNTIME COSTS FOR DATA CENTERS

$4.4M PER DAY*
120,500 BARRELS OF OIL LOST PER DAY OIL&GAS SEGMENT

$150M PER OUTAGE
AIRLINE LOST A SWITCHGEAR WITH 3.7% STOCK DROP IN 2 DAYS IN 2016

$100k PER PANEL
STEEL WORKS LOSS PER YEAR PER PANEL

$20k PER PANEL
ANNUAL LOSS IN SEMI-CONDUCTOR PRODUCTION

* Source: Hartford Steam Boiler

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*A 1999 Electric Power Research Institute (EPRI) study pegged total direct and indirect costs of an arc flash incident
*news.thomasnet.com/company story/downtime-costs-auto-industry-22k-minute-survey-481017
*Cost of Data Center Outages (D) Ponemon Institute
*The Economic Impact of August 2003 Blackout (E) done by ELCON
*Copper Institute (C)
Improve safety
Avoid unexpected failures

Operate more safely
Keep your personnel out of the arc flash zone

Personnel must enter arc flash zone. 4000 injuries occur in the US each year. *

Remote communications enabled, data can be safely transmitted to a remote location

~300
ANNUAL DEATHS IN US ALONE ARE CAUSED BY ENERGIZED ELECTRICAL EQUIPMENT

80%
OF ALL ELECTRICAL ACCIDENTS ARE CAUSED BY ARC FLASH INCIDENTS

$1M TO $15M
POTENTIAL COST OF ONE ARC FLASH INCIDENT*

19,000°C (35,000°F) Hotter than you can imagine
Arc Flash temperatures are hotter than the sun.

1,100kmph (700 mph) Projectile-producing pressure
Arc flash can throw workers across a room. Metal and equipment become shrapnel.

+2,000 burns More than one way to burn you
Each year 2,000+ people seek treatment for serious Arc flash burns.

3 meters (10 feet) Too close for comfort
Arc flash can reach out 3 meters to take a life. Serious-injury zone is even larger.

140 dB An assault on your senses
Light and sound bursts can cause vision and hearing loss.

*A 1999 Electric Power Research Institute (EPRI) study pegged total direct and indirect costs of an arc flash incident
With SWICOM enable condition based maintenance for your plant
An integrated scalable system to monitor your assets.

An intelligent and connected electrical infrastructure designed for real time supervision of the asset condition

An advanced hub receiving rough data, elaborating them and transmitting the information to SCADA.

A platform to manage the whole plant, knowing the KPIs and enabling advanced maintenance
Modular and scalable maintenance of your plant
An integrated scalable system to monitor your assets.

- **Breaker diagnostic**
  - Discover in advance mechanical or electrical anomalies that can lead to a breaker failure

- **Partial discharges detection**
  - Prevent arc flash
  - Prevent catastrophic equipment failure

- **Temperature diagnostic**
  - Detect loose joints
  - Identify load unbalance
  - Prevent temperature related failures

- **Data visualization**
  - Verify the overall status of the plant,
  - Schedule maintenance activities wherever your are
Available offerings:

1. Breaker monitoring through Relion relays
   
   I. Capacitive coupling methodology
   
   II. Most cost effective PD solution available in the market (1 PDCOM for up to 10 panels)
   
   III. Suitable for IEC and ANSI, AIS and GIS, ABB and non-ABB, green and brown field switchgear
   
   IV. UHF possible in case coupler are not present

2. Partial Discharge detection through PDCOM
   
   I. Capacitive coupling methodology
   
   II. Most cost effective PD solution available in the market (1 PDCOM for up to 10 panels)
   
   III. Suitable for IEC and ANSI, AIS and GIS, ABB and non-ABB, green and brown field switchgear
   
   IV. UHF possible in case coupler are not present

3. Wireless Temperature monitoring
   
   I. Suitable for IEC and ANSI, AIS and GIS-(cables), ABB and non-ABB, green and brown field switchgear

4. Data visualization
   
   I. SCADA
   
   II. MyRemoteCare Cloud
   
   III. Local HMI/Mobile APP
Modular and scalable maintenance of your plant

1. Breaker diagnostic

SWICOM, the intelligent hub for breaker diagnostic.
Monitor your circuit breakers through retrieving rough data from RE_615-20 protection relay. Connection is achieved simply by using IEC61850 protocol through ethernet cable.

IEC 61850

2. Partial discharge detection

3. Temperature diagnostic

4. Data visualization

1 SWICOM can be connected up to 24 numbers RE_615/620 Relays are acting as sensor

Monitored parameters:
- Opening and closing times,
- spring charging time,
- slipping and failed spring charging attempt,
- number of operations,
- inactivity days,
- remaining life estimation,
- Contact wear,
- SF6 pressure,
- trip coil supervision
- ambient temperature and humidity (through Swicom)
Modular and scalable maintenance of your plant

Partial discharge is the leading arc flash symptoms, use SWICOM to constantly detect it and make a timely assessment.

1. Breaker diagnostic
2. Partial discharge detection*
3. Temperature diagnostic
4. Data visualization

The PDCOM is based on capacitive coupling methodology.

It is easily installed and connected to the Capacitive Coupler of VIS (Voltage Indication System), and can detect PD internal and external.

One PDCOM can monitor up to 10 panels

The VIS interface is provided to allow PDCOM to retrieve partial discharge measurements for each type of Switchgear, avoiding any dependence on the typology of the VIS

The Capacitive coupler is required*.

*when it’s not possible to install the capacitive coupler or in their absence, it’s possibile to monitor partial discharge through UHF method
Modular and scalable maintenance of your plant

Temperature rise is a critical phenomenon that can lead to arc flashes, you can constantly monitor it with SWICOM. Applicable for AIS/GIS, Green and brownfield

1. Breaker diagnostic

2. Partial discharge detection

3. Temperature diagnostic

4. Data visualization

The Reader acquires temperatures from power parts (it consumes less than 0.5W) It is installed in the LV compartment

The Sensors monitor the temperature (1 per phase) They are wireless and batteryless, with 30 years lifecycle They communicate via radio frequency with the Reader to provide registered measurements

The antenna is the signal amplifier. Two antennas have to be installed in the power compartment where the sensors are installed It allows a stable and efficient communication between the Reader and SAW sensors
Modular and scalable maintenance of your plant

SWICOM provides a local HMI and the APP mobile, Play Store, Apple Store

1. Breaker diagnostic

Monitor your plant

2. Partial discharge detection

Local

3. Temperature diagnostic

Mobile

4. Data visualization

Control room

Cloud

SWICOM app
Connection via Smartphone/Tablet
Data visualization enabled wherever I am in the cabinet

Local HMI to visualize:
diagnostic, health status, measurements, KPIs and sensors connectivity status
Modular and scalable maintenance of your plant

With SWICOM it’s possible to provide KPI and measurement data control room, using Modbus over TCP/IP or IEC61850 protocols.

1. Breaker diagnostic

2. Partial discharge detection

3. Temperature diagnostic

4. Data visualization

Monitor your plant

Control room

Local

Mobile

Cloud

SWICOM provides the KPIs to the control room via IEC61850, as for REF615/620

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Modular and scalable maintenance of your plant

With MyRemoteCare cloud platform it’s possible to evaluate overall plant health status by remotely, plan maintenance activities and having ABB Experts support in case of need.

1. Breaker diagnostic

2. Partial discharge detection

3. Temperature diagnostic

4. Data visualization

Monitor your plant

TCP/IP

3G/4G

Enable Cloud solution with advanced algorithms
Multiplant data visualization, optimized asset management
Dashboard, reports and alert notifications real time
Cybersecurity proof network
Modular and scalable maintenance of your plant

1. Breaker diagnostic
2. Partial discharge detection
3. Temperature diagnostic
4. Data visualization

Real time plant supervision

- Monitor your asset throughout its life
- Mange on site activities...remotely
- Plant geolocation
- Schedule activities
Applications
Sector and real cases

- Utility: Energy distribution companies
- Industry: Industries in which process continuity is vital
- Other Critical Power: Sectors and infrastructure in which it’s necessary to maximize efficiency of the plants, e.g. marine

Solution for new and existing switchgears
Why ABB

Technical advantages

First to propose partial discharge detection through a cost effective solution accessible for everyone

Balance between costs and benefits, with a competitive price

Breaker diagnostic without any additional sensor

We are the forefront in our sector, using protection relays already installed in the switchgear

Wireless sensors and without batteries

Lifecycle up to 30 years
Inspection free (every 15 years)