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Agenda

- New trends and importance of installation monitoring
- New standards and certifications
- Benefits of metering and monitoring solution implementation
- Smart electrical components
- Intelligent metering and monitoring systems
- Flexible solutions for new and existing installations: Application examples
New Trends
Technologies which are changing the world we know

Cloud computing, big data, internet of things (IoT), artificial intelligence (IA), industry 4.0 are phenomenon which are changing the approach to the electrical distribution as we know it today.

Importance of energy efficiency in electric installation

Market trends

- Global building & infrastructure sector is responsible for almost 40% of energy consumption
- Global building & infrastructure sector has a huge growth 3% Annual growth

To allow future growth of the segment without having an impact on the environment, energy efficiency must increase.

Evolution of the electrical distribution

Distributed electrical energy generation

**Microgrid concept**

Electric grid is adopting a microgrid concept, to allow local electric energy production, very often from renewable sources. Companies are starting to manage electricity on their own.
Aperace of the green factories

Sustainability and energy efficiency are main drivers

**Future of factories**

Circular economy, sustainability and energy efficiency are the key to be considered by the factories of the future. The new factories are using more energy from renewable sources, reducing waste and implementing processes to maximize the resource utilization.
# Metering and monitoring systems

**Trends and requirements**

## In the past

1 external power meter for local monitoring of the electrical installation with high accuracy
- If necessary, additional meters with the local monitoring

## Today

- Additional metering devices along the distribution with high and mid/high accuracy and local monitoring system

  **Advanced power monitoring and network performance:**
  - $P$, $Q$, $S$, $E_a$, $E_r$, $E_{ap}$, $f$, $I$, $I_{N}$, $U$ and/or $V$, $PF$, $THD_U$ and/or $THD_L$, $THDI$ and/or $THD_I$

  **Basic Power Monitoring:**
  - $P$, $Q$, $S$, $E_a$, $E_r$, $E_{ap}$, $f$, $I$, $I_{N}$, $U$ and/or $V$, $PF$

  **Energy monitoring:**
  - $E_a$

## In the near future

- All the electrical parameters to be measured with high accuracy
- Devices exchanging the information among them and with cloud
Energy Efficiency in Electrical System

Certification & Standard

<table>
<thead>
<tr>
<th>International Standard</th>
<th>National Regulation</th>
<th>European Directive</th>
<th>Certification System</th>
</tr>
</thead>
<tbody>
<tr>
<td>- ISO 50001 Energy management systems – Requirements with guidance for use (ISO 50001:2018)</td>
<td>- Many Countries developed local regulation for measuring new constructions and renovations</td>
<td>- The Energy performance of buildings directive requires that all new buildings must be nearly zero-energy buildings (NZEB) as of 31 December 2020</td>
<td></td>
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<tr>
<td>- IEC 60364-8-3 ed. 1 Low-voltage electrical installations</td>
<td></td>
<td>- Energy that NZEB require should comes mostly from renewable energy sources</td>
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</tr>
<tr>
<td>- UNI EN 15232 Energy performance of buildings – Impact of Building Automation, Controls and Building Management</td>
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Metering and monitoring is a key requirement for the energy efficiency improvements

February 12, 2021
Slide 9
What is ISO 50001

Introduction

ISO 50001 is an international voluntary standard for energy management.

A continuous improvement model is divided into four steps: Plan, do, act and check.

ISO 50001 is based on the same management system model used for ISO 9001 and 14001. This compatibility makes it easier for organizations to integrate energy management into their quality and environmental management efforts.

However, ISO 50001 adds new data-driven sections related to energy planning, operational control and measuring and monitoring.
ISO 50001
Benefits

By achieving certification to this international, best-practice Energy Management standard, customers’ organization will accrue some of the numerous benefits of ISO 50001, including:

- Energy reduction, even up to 10% within first 12 months
- Reduced greenhouse gas (GHG) emissions and carbon footprint
- Globally recognized International Standard
- Assist in compliance with current and future voluntary and/or mandatory energy efficiency targets
- Improved corporate image and credibility among customers, clients and stakeholders
- Informed decision-making processes from system design to operation and maintenance
- Increased energy awareness among staff members at all levels
- Improved operational efficiencies and maintenance practices
Recommendation from IEC 60364-8-1

Metering requirements

- For the incoming part of the facility it is necessary to have the most detailed monitoring of all electrical parameters

Advanced power monitoring and network performance:
- P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF, THDU and/or THDV and/or THD-RU and/or THD-RV, THDI and/or THD-RI

- Less details is necessary for the sub distribution part

Basic Power Monitoring:
- P, Q, S, Ea, Er, Eap, f, I, IN, U and/or V, PF

- Only the monitoring of the energy is required for the final distribution

Energy Efficiency:
- Ea
Smart metering devices

ABB solution for metering requirements

**Metering devices**

- Circuit breakers: Emax 2 and Tmax XT
- Digital Relay: Ekip UP
- ATS: TruONE
- Fusegear: InLinell ITS2

- Circuit breakers: Emax 2 and Tmax XT
- ATS: TruONE
- Fusegear: Slimline XRG and InLinell ITS2
- ITS2 with OS and OT switches
- UPS
- Network Analyzers: M4M 20 and M4M 30

- Circuit Monitoring System: System pro M compact® InSite
- Network Analyzer: M4M 20
- EQ meters
Our Value Proposition

ABB smart solutions for metering and monitoring are flexible and grant a 7% improvement in energy efficiency, ensuring access to LEED Certifications and allowing a payback time of less than 3 years. Furthermore, you can connect your facility to the cloud in 10 minutes, start monitoring the entire electrical system and satisfy demanding new international standards and regulations.
Measurement Accuracy
Importance of accurate measurements

Why does accuracy matter?

- To identify the inefficiencies within electrical distribution
  - Measuring losses on highly efficient electrical equipment (e.g. 98%) with non accurate devices (e.g. class 2) will not provide any valuable information
- To identify inefficiencies on a component level
  - Component inefficiency can be recognized immediately by having precise and accurate information
- To make right decisions to improve energy efficiency
- To avoid unnecessary actions
  - Having inaccurate information can lead to actions which are not based on accurate and correct information, risking to make inefficient investment
## Data & Measurements
Measurements certified according to IEC61557-12

<table>
<thead>
<tr>
<th>Guaranteed accuracy</th>
<th>Defined measuring range</th>
<th>Influence quantities</th>
<th>Zero-blind measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>This specifies the limits of the power metering and monitoring devices (PMD) uncertainty, over the specified measuring range, under reference conditions.</td>
<td>This specifies the minimum and maximum values of quantities between which the limits of measurement uncertainty are defined.</td>
<td>These are environmental quantities (temperature, climatic conditions, electromagnetic perturbations / EMC, etc.) that may happen in harsh conditions encountered in switchboards or electrical cabinets. The standard specifies maximum permitted variations of accuracy due to those influence quantities.</td>
<td>To ensure reliable and accurate measurements, IEC 61557-12 requires zero blind measurements (i.e. gapless measurements) for several quantities, particularly for energy measurements. This means that sampling shall be performed continuously, not from time to time (i.e. with gaps).</td>
</tr>
</tbody>
</table>

Performance classes defined in IEC 61557-12
Data & Measurements
Class 1 measurements certified according to IEC61557-12

With Ekip Touch trip unit platform with 1% accuracy is possible to measure down to 0.4% of the In:

- i.e. with an XT2 Hi-Touch 100A the lowest measurable values is 0.4A

Diagram:

- Uncertainty
- +/- 1.5% readings
- +/- 1% readings
- Power Factor = 1
- Power Factor = 0.5 inductive and 0.8 capacitive
Smart metering devices

Same user experience over the whole range of protection devices

Emax 2 and Tmax XT new generation of trip units offer same user experience over the whole range of circuit breakers from 160A up to 6300A

New trip units provides:

- **Class 1** measurements certified according to IEC61557-12
- **0.5%** accuracy for Current and Voltage measurement
- **1%** accuracy for Power and Energy measurement
Power Quality Analysis

Fundamentals

Power Quality Causes

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Power quality disturbances</th>
<th>Source</th>
<th>Victim</th>
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<tbody>
<tr>
<td>Motor</td>
<td>X</td>
<td>X</td>
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<td>Motor Starting</td>
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<td>X</td>
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<td>Variable Speed Drives</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Transformers</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Capacitor bank</td>
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<td>X</td>
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<tr>
<td>Generator set</td>
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<td>X</td>
<td></td>
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<tr>
<td>UPS</td>
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<td>X</td>
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<tr>
<td>Lighting</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Cables</td>
<td></td>
<td>X</td>
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<tr>
<td>PLC</td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Office equipment</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Circuit breaker</td>
<td></td>
<td>X</td>
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</tr>
</tbody>
</table>

Power Quality Consequences

- Unexpected power supply failures (breakers tripping, fuses blowing)
- Equipment failure or malfunctioning
- Equipment overheating (transformers, motors, ...) leading to their lifetime reduction
- Damage to sensitive equipment (PC’s, production line control systems, etc.)
- Electronic communication interferences
- Increase of system losses
- Need to oversize installations to cope with additional electrical stress with consequential increase of installation and running costs and associated higher carbon footprint
- Penalties imposed by utilities because the site pollutes the supply network too much
- Connection refusal of new sites because the site would pollute the supply network too much
Ease to analyze power quality

By using only switching devices in the installation it is easy to detect power quality issues and take actions to improve the quality of the energy, thus minimizing the energy losses and potential failures.

All the following parameters are continuously monitored:

- Harmonic analysis (up to 50th harmonic)
- Hourly average voltage values
- Short voltage interruption
- Short voltage spikes
- Slow-voltage sags and swells
- Voltage unbalances
Device Connectivity & Communication
Flexible solution for any application

Emax 2, Tmax XT (new generation), Ekip UP and TruONE ATS devices are embedded with several native communication protocols to allow interconnection among all ABB devices as well as 3rd party devices:

- Ekip Com Modbus RTU
- Ekip Com Profibus DP
- Ekip Com DeviceNet
- Ekip Com Modbus TCP
- Ekip Com ProfiNet
- Ekip Com Ethernet/IP
- Ekip Com IEC 61850*
- Ekip link*
- Ekip Com Hub
- Ekip Signalling (2K, 4K* and 10K**)
- E-Hub 2.0**
- Ekip Com Modbus DP module
- Ekip Com DeviceNet module
- Ekip Com Modbus TCP module
- Ekip Com IEC 61850 module
- Ekip Com Profinet module
- Ekip Com Profibus DP module
- Ekip Com Modbus RTU module
- Ekip Com Hub module

* Not available with TruONE
** DIN-rail mounted
Local monitoring and control of the installation
Flexible solution to fit all installation requirements

Lite Panel
It is a local control panel of 7 inches that can monitor and control max 20 devices connected via Modbus TCP/IP or Modbus RTU

Ekip Connect 3
Ekip Connect is the ABB programming and commissioning software tool that allows the user to unlock the full potential of ABB devices

EPiC commissioning tool
ABB devices with Bluetooth module for complete compatibility with unique EPiC commissioning tool
Remote monitoring of the installation

Start monitor in 10 minutes

**ABB Ability Energy and Asset Manager**

*cloud based monitoring*

- Easy integration
- Remote supervision of facility
- Interactive images through tags & markers
- Alerts management: reduce downtime & improve efficiency
- Scheduled reports
- Power quality (THD)
- Data storage
ABB Ability™ Energy and Asset Manager

Predictive maintenance

- Overall plant health conditions
- Smart visualization (traffic light) to monitor the system at a glance, with proactive alerts
- Operation and Maintenance cost saving thanks to optimized maintenance schedule
- Spare parts management: you know exactly what you need, no waste of time
- Reduced downtime
- Based on an algorithm that considers:
  - Environmental conditions
  - Utilization conditions
  - Circuit breaker Aging
  - Measures (humidity/vibration/temperatures)
Application example 1
Greenfield installation

Easy monitoring of a new installation

Fast and easy solution to implement **metering** on all electrical distribution levels

Just by using switching devices it is possible to have a **complete installation overview**

Using the embedded **Modbus TCP** communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system

By adding the gateway **E-Hub 2.0** (din rail mounted) or **Ekip Com Hub** (embedded on devices) in 10 minutes it is possible to connect to **ABB Ability EDCS cloud platform** and start plant monitoring.
Design and build new smart switchboard
We make connectivity simple

Simplest hardware for monitoring

Thanks to ABB unique solutions connection between devices is very simple and immediate
Design and build new smart switchgear
Full documentation for an easy design

ABB smart switchgear solutions

- Fully type tested and ABB proven
- Simple to realize offering up to 66% less cables and up to 10% less connectivity components
- Sustainable, offering from 7% up to 20% energy efficiency improvements
- Reliable and simple to maintain offering up to 36% less maintenance cost
- Future proof, offering upgradability without physical intervention on the switchgear
Largest Swiss rice mill monitors energy distribution digitally

La Riseria

**APPLICATION**
Food processing plant

**COUNTRY / CUSTOMER / SITE**
Switzerland / La Riseria / Ticino

**CUSTOMER NEEDS**
M-Industrie has set sustainability targets that require significant advances in energy efficiency. More precise monitoring of the power consumed in every part of its operations is key. ABB Ability EDCS enables plant operators to access this data anytime, anywhere.

**SOLUTION**
- ABB’s EDCS
- Two low-voltage distribution boards
- Emax 2 circuit breakers, Tmax T4 and T5 molded case circuit breakers
- CMS-700 circuit monitoring sensors

Link to online story
Application example
Greenfield installation with switches and fusegear

Easy monitoring of a new installation

The same principle, explained in example 1, to have metering monitoring and control is valid also for installation with fuses and transfer switching devices.

Fast and easy solution to implement metering on all electrical distribution levels.

Just by using switching devices it is possible to have a complete installation overview.

Using the embedded Modbus TCP and Modbus RTU communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system.

By adding the gateway E-Hub 2.0 (din rail mounted) or Ekip Com Hub (embedded on devices) in 10 minutes it is possible to connect to ABB Ability EDCS cloud platform and start plant monitoring.
Upgrading solutions: tailored according to needs
Our offer

1. Light upgrade
   - Once you have a new digital enable product, add further digital functions or solutions
   - No downtime
   - No impact on the electrical installation

2. Medium upgrade
   - Unlock digital functionalities by digitally enabling the products
   - No or minimal downtime
   - Very light impact on the electrical installation

3. High upgrade
   - Replace aged devices with ABB retrofitting kits
   - Minimal possible downtime
   - Minimized installation impact
Application example 3
Brownfield installation

Easy monitoring of an existing installation

The same principle, explained in example 1, to have metering monitoring and control is valid also for existing installation.

Fast and easy solution to implement metering on all existing electrical distribution levels can be done using external meters and relays.

With no or minimal impact on the installation it is possible to have a complete installation overview.

Using the embedded Modbus TCP communication protocol the device data can be immediately collected and transferred to any monitoring and/or control system.

By adding the gateway E-Hub 2.0 (din rail mounted) or Ekip Com Hub (embedded on devices) in 10 minutes it is possible to connect to ABB Ability EDCS cloud platform and start plant monitoring.
Smart Upgrade and Update
Flexible and sustainable solutions to renew any low voltage distribution system

Smart upgrade and update solution offers

- Maximum flexibility to choose the most suitable solution for your low-voltage distribution system
- Up to 70% cost saving to upgrade your electrical installation, if compared to traditional replacement
- ABB and 3rd party equipment can be easily upgraded, with solutions certified for the global market
- Extend the lifespan of your electrical system, keeping it live and efficient as long as possible, minimizing CO2 emissions and raw materials usage
ABB helps power the Burj Khalifa

APPLICATION
Buildings

COUNTRY / CUSTOMER / SITE
UAE / Burj Khalifa

CUSTOMER NEEDS
Considering the dimension of Burj Khalifa building, to manage key assets it’s a big challenge: 163 floors, 400 electrical loads, including 57 elevators and a 24MW air condition system, just to mention few.

SOLUTION
- Real-time sensor data
- Condition monitoring
- Upgrade of existing devices
- Predictive maintenance functions
Smart Upgrade and Update
Stay tuned

Next webinar

Smart Solutions to upgrade a LV electrical installation

Would you like to learn more about ABB solutions to upgrade a low voltage electrical installation, with a 70% cost saving compared to traditional system replacement?

Wednesday, October 21st
- 9:00 AM CET
- 4:00 PM CET

We will get in touch with you soon
Intelligent Distribution

Useful links

- Smart Metering and Monitoring Web Page: link
- Smart Switchgear Web Page: link
- Smart Upgrades and Updates Web Page: link
- Efficiency of Electrical System. Introduction to IEC 60364-8-1: link
- Smart Switchgear for Building and Infrastructure package: link
- Smart Upgrade & Update Article: link
- Smart upgrade for Emax 2: link