Innovation highlights

ABB's top innovations for 2015

Innovation comes in many forms. Sometimes it takes the shape of radical new concepts applied to real-life problems, and at other times, it appears as new ways to utilize existing technologies. Always striving to lead through innovation, ABB is continuously advancing its product portfolio and developing technologies to better meet the changing needs of its customers. Here, ABB Review presents the highlights for 2015, some of which are discussed at greater length in this and forthcoming issues of the journal.

YuMi®, creating an automated future

ABB's new dual-arm robot – YuMi – is the world's first truly collaborative robot designed for a new era of industrial automation. The robot is inherently safe, allowing for barrier-free collaboration with humans in a more productive, side-by-side working environment.

YuMi's control software, precision and innovative design are key to its operation. To further enhance safety, it has lightweight components padding to absorb energy upon impact, and eliminates pinch points.

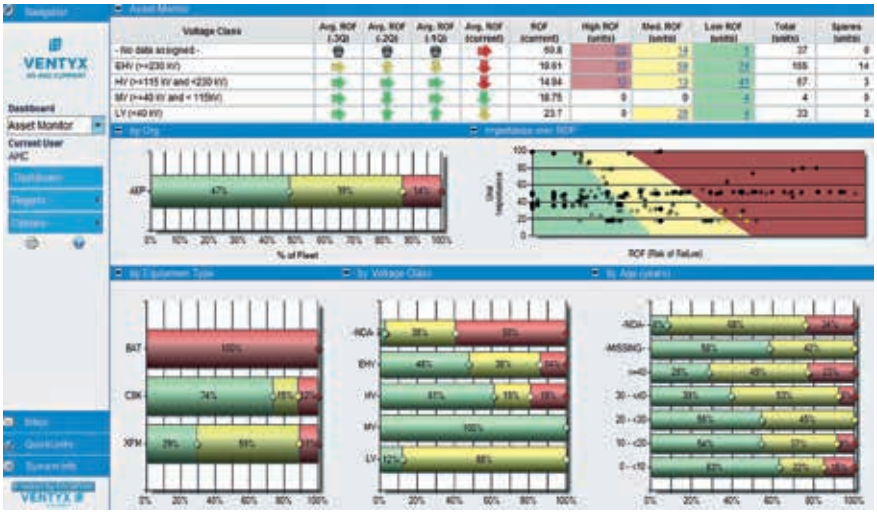
Designed for small-parts assembly, ABB's dual-arm robot meets the ever-changing production requirements of the consumer electronics industry, but can be used in any process with similar delicate demands.

YuMi is part of an overall system, featuring adaptable hands, flexible parts feeders, vision guidance and state-of-the-art control software. Its small size minimizes factory floor footprint and enables installation in work stations currently only occupied by people. Additional features include an integrated robot controller and two 7-axis arms, as well as sufficient payload, speed and protection for capable operation in most small parts assembly environments.

The name YuMi is derived from "you" and "me" – implying robot and human partnership. More details will be available when the dual-arm robot is introduced to the market at the Hanover Fair in Germany in April 2015.

A full-length article on YuMi will appear in an upcoming edition of ABB Review.

The real world: Maximizing reliability on a budget



Company maintenance budgets are never large enough to take care of all the issues that arise in old electrical equipment. ABB's Asset Health Center™ (AHC) is the key to moving from time-based maintenance activities to condition-based management of high-voltage assets. ABB's expert-developed algorithms convert analytical data into information that allows informed decisions to be made when prioritizing maintenance actions to improve equipment reliability.

Whether by using only occasional observations, annual dissolved gas analysis (DGA) data, sophisticated monitoring systems or structured inspections by an equipment expert, AHC takes all available data and provides actionable information, thus maximizing the value gained from each and every maintenance dollar.

AHC provides timely notifications when abnormal asset behavior is detected and provides an immediate view of equipment condition long before the substation gate is unlocked.

This allows sending the right people, with the right equipment, and at the right time to take actions that improve asset reliability. The flexible ABB performance models behind AHC can also be integrated with other asset management solutions to provide a perfect answer for equipment reliability needs.

New release: System 800xA v6

Since its introduction in 2004, ABB's distributed control system (DCS), Extended Automation System 800xA, has been enabling productivity by consolidating process, electrical, safety and telecommunications in one automation platform.

System 800xA's sixth-generation release has been specially developed to support upgrades of older DCSs running on unsupported operating systems such as Microsoft Windows XP® and simultaneously helps customers reduce operational costs associated with maintaining the automation system.

In addition to the adoption and implementation of technologies such as virtualization, System 800xA v6 includes an innovative software installer that harnesses the power of multicore technology found in today's servers and workstations to significantly reduce the required automation infrastructure. The number of machines in an automation system can be reduced by as much as 50 percent, and more importantly, capital and life-cycle costs are reduced.

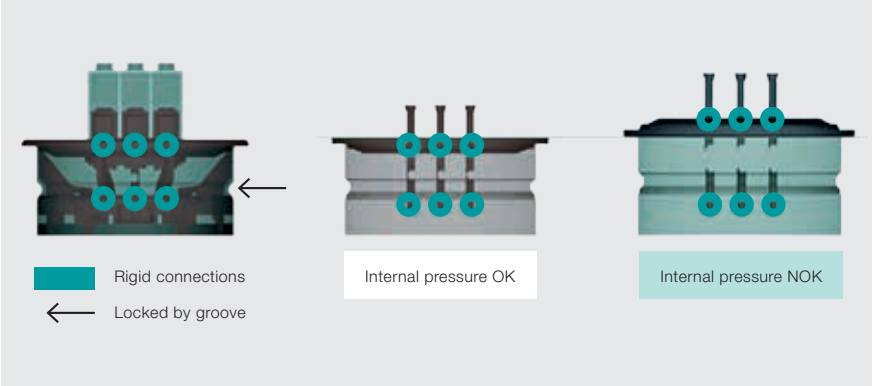
Other additions to v6 include:

- Wireless routers enabling the safe and secure deployment of mobile operator clients.
- New, more secure means to provide much needed data to the enterprise from the control layer.
- A list of operator effectiveness improvements including trend and alarm list enhancements, an embedded public address system, and a KNX interface that more closely connects an operator's physical environment to the overall automation solution.

Putting a cap on reactive power

Capacitors may have been around for more than 250 years, becoming irreplaceable in countless applications, but this does not mean that their development is over. ABB's newest QCap low-voltage capacitor sets new standards in terms of reliability, quality and safety.

One of the major challenges in power capacitor design is heat. Overall, electrical losses within a capacitor are low, but as low thermal conductivity is intrinsic to the materials used, temperatures can build up and degrade the capacitor. The QCap design is optimized for low losses, increasing its operating lifetime and reliability.



The QCap excels in more than just optimal thermal performance however. The capacitor is also self-healing, meaning that when an electrical fault occurs, the resulting arc burns a hole isolating the faulty area. Such an occurrence reduces the capacity by about one part in a million while avoiding a potentially destructive spread of the fault.

But QCap's innovative approach doesn't stop there either. Each self-healing event emits a small amount of gas. Over time and as the capacitor ages, the gas accumulates. When the gas pressure surpasses a threshold, it causes the can's lid to pop upwards, severing the connecting cables and hence isolating the faulty device.

Read more about QCap on pages 53–59 of this edition of ABB Review.

PASS hybrid technology steps up

For many, high-voltage equipment has always been divided between air-insulated switchgear (AIS) and the more compact, but more expensive, gas-insulated switchgear (GIS). This picture changed dramatically some 20 years ago when ABB introduced PASS (plug and switch system). PASS combines the best of the AIS and GIS worlds to create mixed technology switchgear (MTS). Even if basic equipment costs are higher than for AIS, MTS delivers a lower cost of ownership.

In 2013, ABB announced the launch of a 420 kV high-voltage hybrid switchgear known as PASS M0S 420 kV. This means the PASS product family now covers voltages from 72.5 to 420 kV with breaking currents from 31.5 to 63 kA.

In addition to standard modules, a special solution called the PASS M0H offers a complete high-voltage switchyard with an "H" configuration as a single transportable unit. The 420 kV PASS hybrid module retains all of the PASS family benefits and each PASS module is equivalent to a complete switchgear bay. The preassembled and factory-tested PASS M0S 420 kV can be easily transported and quickly installed, without the need to assemble any active parts. In order to transport the fully assembled product, the (3.6 m, 350 kg) insulators are rotated into a compact position in the factory and returned to the in-service position on-site. This key feature is unique to PASS technology.

Increasing the capacity of distribution grids

The distribution grids that soak up power from photovoltaic (PV) and wind installations were designed to cope with a certain energy flow – and the power generated by PV and wind installations can be a multiple of that design limit. In many cases, the limiting factor is not even the transmission capability as such, but voltage range compliance.

Conventional solutions involve network upgrades – but a line voltage regulator (LVR) can easily solve the problem at far less expense. An LVR is able to automatically adjust a voltage, within a certain range, to a desired value.

ABB has introduced a new LVR for the low-voltage (LV) distribution grid. It is available in standard ratings of 250 kVA, 125 kVA or 63 kVA and allows voltage adjustment of +/- 6 percent in steps of 1.2 percent of the voltage. The LVR can be mounted in a standard cable distribution cabinet and placed anywhere along the LV line, including at the output of a distribution transformer. A typical cabinet location would be in the vicinity of a roof-mounted PV installation. For applications in the medium-voltage (MV) grid, a corresponding regulator has just been developed. The MV LVR can handle power up to 8 MVA, at voltages of up to 24 kV, with a regulation range of +/- 10 percent.

DS1: Transient-free, diode-based capacitor switching

With DS1, ABB has reached a milestone with the first capacitor switch based on semiconductor technology that allows synchronized switching. DS1 is the first indoor medium-voltage apparatus of its kind in terms of innovation and performance. The switch, fully dry-air insulated, is able to perform opening and closing operations on capacitor banks without causing any transient voltage or inrush current and eliminating the probability of restrike occurrence.

This is made possible by the embedded control unit, which enables optimized switching that is precisely synchronized with the AC network parameters. The product connects the capacitors at zero voltage crossing and disconnects them at zero current – with a precision of a few microseconds.

Thanks to DS1, capacitor bank switching will no longer be a delicate operation since any side effects on the distribution network and the capacitors are avoided. This prolongs component product life and eliminates the need for additional equipment such as inrush reactors.

Moreover, this new capacitor switch can perform up to 50,000 operations with a switching frequency of more than one operation per second. It is rated at up to 17.5 kV and 630 A.

Industrial customers will benefit from DS1's power factor correction capabilities, and utilities will get the most out of it for reactive power compensation.

Something new under the sun

Operating a photovoltaic (PV) installation at the top of the low-voltage range – defined by IEC standards to be 1,500 VDC – reduces equipment and labor costs. However, running devices at this voltage level can be problematic. For instance, interruption can be difficult due to so-called critical currents that cannot be interrupted. ABB's new T7D PV-E hybrid breaker not only works effortlessly at voltages up to 1,500 VDC but it also avoids the critical current issue.

In the T7D PV-E, the critical current problem is counteracted by using power electronics for low-current interruption. Because the power electronics are not in the main current path, power losses are as low as in normal electromechanical breakers and there is thus no need for cooling. Once higher currents flow, the power electronics are no longer required and they are switched off. Very small components are used – even at the device's 1,600 A rating – making the power electronic unit extremely compact.

As a further bonus, the electronics are powered through an energy harvesting unit that exploits the energy of the contact arc. In addition, the electronics sleep (and are isolated) when the breaker rests in the closed or open position.

Laying the groundwork for tomorrow's electricity grids

Supporting the European Union's 2020 climate and energy targets is the largest EU-funded smart grid initiative – Grid4EU – a "large-scale demonstration of advanced smart grid solutions with wide replication and scalability potential for Europe." ABB is collaborating with three of the six European energy distributors who make up the Grid4EU consortium, to build and test the scalability and replicability of new and innovative solutions for large-scale distribution networks.

The first demonstration project – Demo 1 – is in partnership with RWE in Reken, Germany. Fully integrated grid automation technology monitors the network condition and reconfigures the network topology to minimize the impacts of faults, avoid overload situations and reduce network losses using a distributed software system.

Demo 2, in collaboration with Vattenfall in Uppsala, Sweden, focuses on how to monitor and control the low-voltage (LV) network based on existing advanced metering management technology for the Nordic region. ABB provided measuring equipment in secondary substations and visualization tools for alarm and event management and statistical evaluation.

In conjunction with CEZ Distribuce in Vrchlabi, Czech Republic, Demo 5 focuses on designing, implementing and testing automation in medium-voltage and LV grids that are newly equipped with remote controlled devices, fast communication infrastructure and local SCADA (supervisory control and data acquisition) systems to support automated and islanding operations.

The Grid4EU program drives the development of cost-effective and scalable solutions for supervision and control in parts of distribution networks that previously did not have this capability. Such far-reaching management capability is essential for the safe integration and increased hosting of distributed renewable resources, enabling the reduction of carbon emissions while maintaining grid reliability.