

CASE STUDY - PMA CABLE PROTECTION ROBOTICS

PMA® helps to develop new construction methods

Digital fabrication technologies

PMA

From the research stage to practical architectural application, this is the first time that a large-scale architecture project has been implemented using ABB robots and PMA cable protection products.

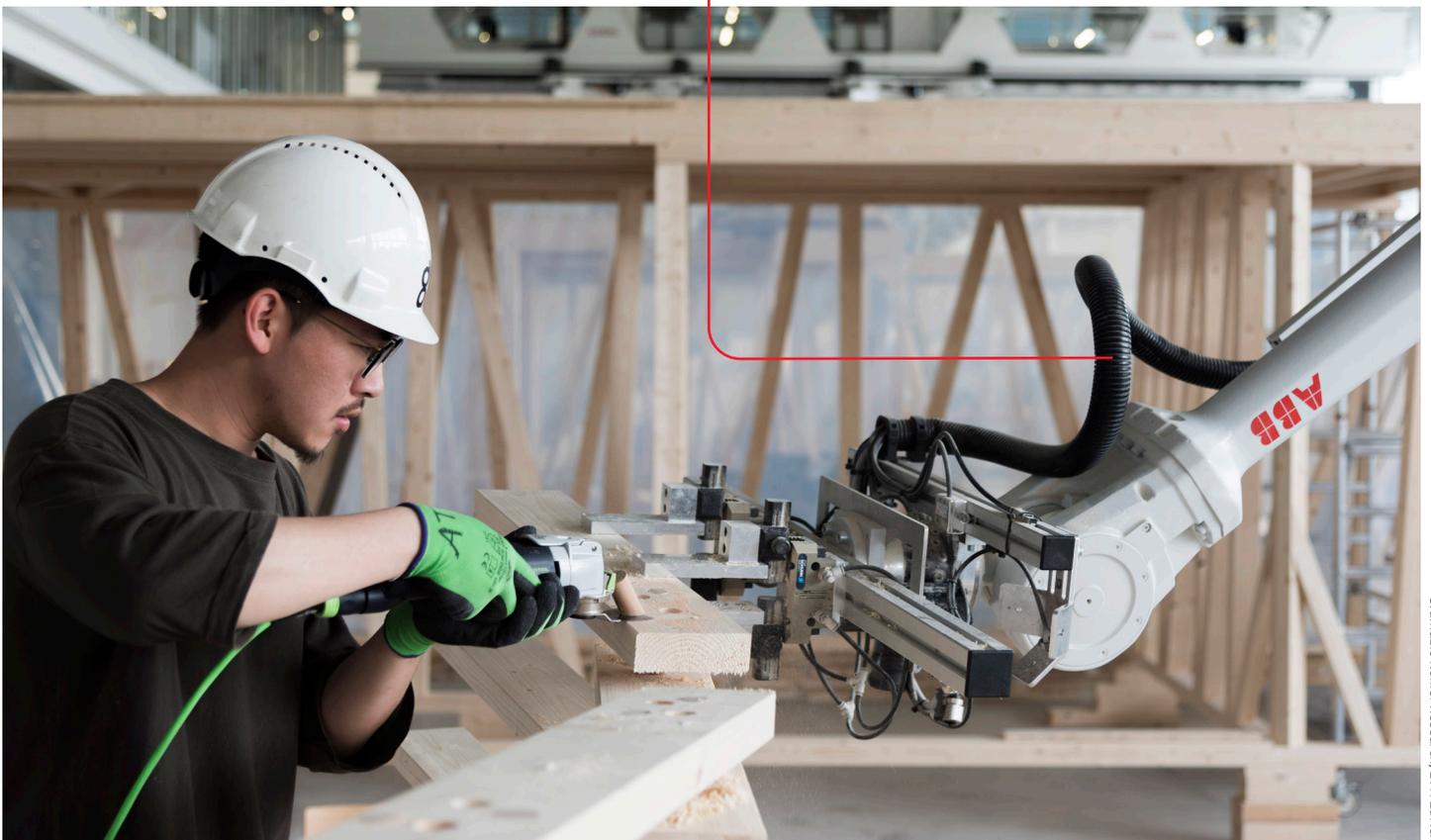
Wooden building modules are pre-fabricated in ETH's Robotic Fabrication Laboratory by two ABB robots equipped with PMA's cable protection products.



Equipped with
XR90
Multi-layer
corrugated conduit

As part of the DFAB HOUSE construction project, researchers at ETH Zurich are working together with experts and planning specialists from the building industry to research and test how digital fabrication can alter the design and construction process. ABB Robotics and ABB PMA® cable protection are both playing an important role in this new digital fabrication technology.

This new construction method has now left the research laboratory and has been realised in an architectural project in the form of the three-storey DFAB HOUSE (see further details at the end of this article) assembled in Switzerland at Empa's and Eawag's NEST research building in Dübendorf. This is the first time that a large-scale architecture project has been implemented using **ABB robots** and **PMA cable protection products** at the world's only Robotic Fabrication Laboratory located at ETH Zurich and the NCCR Digital Fabrication facility.





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Shuttering and reinforcement functions are combined in a robot-produced 'mesh mould' construction system. An ABB industrial robot fabricates a 3D lattice structure which subsequently acts as both shuttering and reinforcement.

This ground-breaking project is part of the national research effort initiated at ETH Zurich with its emphasis on digital fabrication. Eight different ETH faculties, Empa (the Swiss Federal Laboratories for Materials Science and Technology) and industrial partners and planners from more than 30 companies, including ABB, are involved in the DFAB HOUSE.

“As a partner in the DFAB HOUSE project, ABB is involved both in basic research and in knowledge transfer between research and industry.”



ABB teams are continuously testing new robotic technology equipped with **PMA XR90** Multi-layer corrugated conduit.

The project's aims are to demonstrate the potential of new digital construction processes under real-life conditions and to validate various 'smart home' solutions and energy technologies.

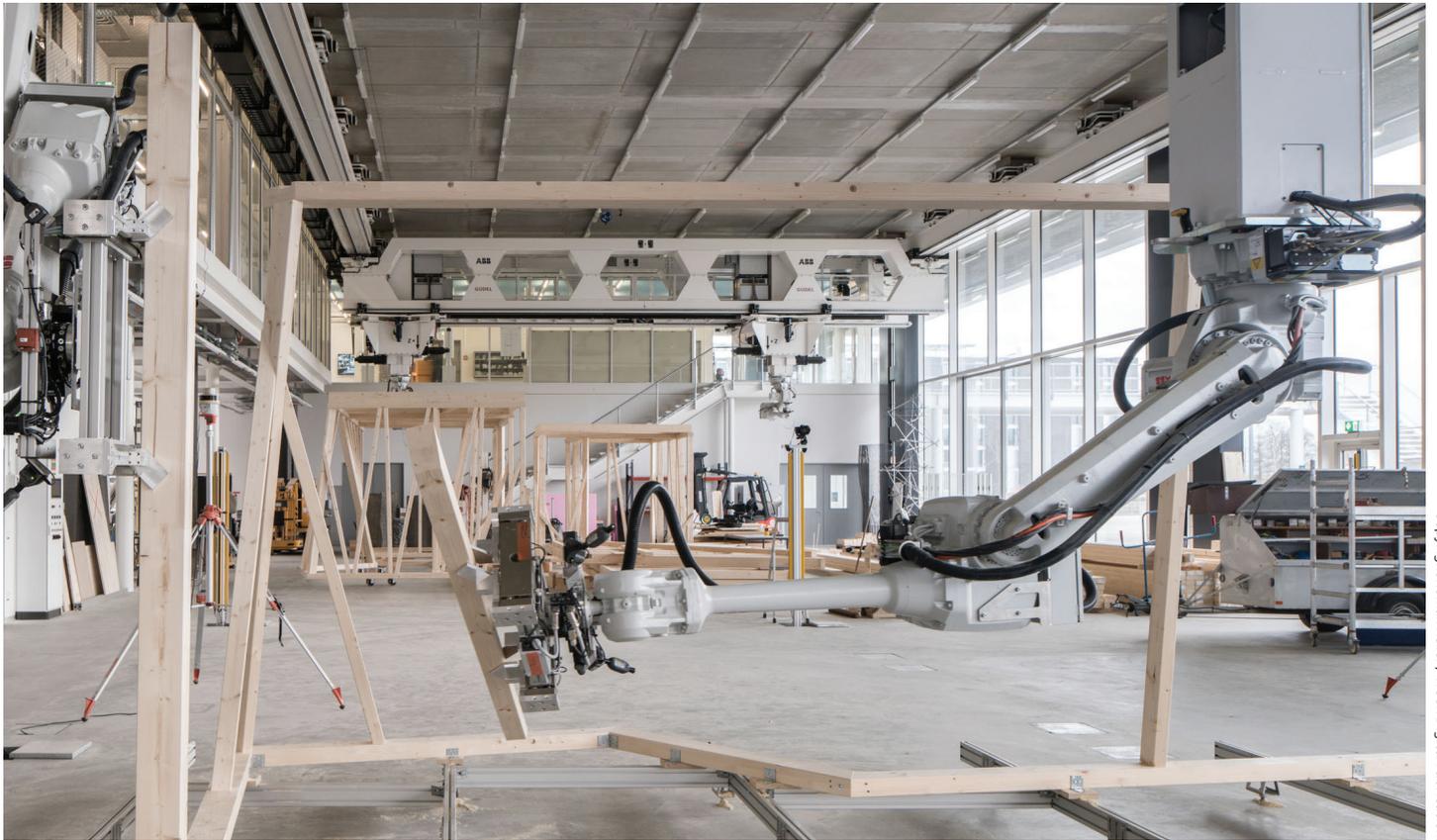
Bernhard Caviezel, product marketing director at ABB Switzerland, continues, “This innovative building project is a vivid example of what we can all achieve when human beings and technology work hand in hand.”

Altogether, **six new digital processes** were used during construction, from 3D printing of the shuttering components to producing a lightweight facade which lets in light at the same time offering outstanding insulation properties. The 'Spatial Timber Assemblies' process was used for the upper stories. These wooden building modules were pre-fabricated in ETH's Robotic Fabrication Laboratory by two ABB robots equipped with PMA's cable protection products.



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The ‘Spatial Timber Assemblies’ process was used during construction. The wooden building modules were pre-fabricated in ETH’s Robotic Fabrication Laboratory by two ABB robots equipped with PMA’s cable protection products.

With over **500,000 robots installed worldwide**, ABB leads the way in the field of industrial robots, satisfying all the productivity and safety requirements of its customers. In addition, ABB’s range of products also includes individual equipment components for robots, such as ABB’s PMA cable protection solutions to help ensure overall quality and reliability. Automation applications demand cable protection products which are able to constantly withstand extremely challenging movements.

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“Customers want robotics solutions which work without any interruptions.”

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Benoit Gerber,
Local Product Manager,
Robotics at ABB in
Baden, Switzerland.

According to **Benoit Gerber**, Local Product Manager, Robotics at ABB in Baden, Switzerland: “Robot cables are exposed to high stress levels and can represent the system’s weak point. PMA provides a comprehensive range of products specifically designed to protect these cables and, as a result, can increase robot operating life and reduce the costs associated with system downtime and maintenance.

The automation solutions developed by ABB satisfy these high demands in key aspects: specially designed conduits, clamps and abrasion protection sleeves provide highly effective protection for all moving parts, massively reducing torsional forces.



Over
500,000

Robots installed
worldwide





ABB Robotics advances construction industry automation to enable safer and sustainable building

ABB's efforts to drive automation in the construction industry with new robotics automation solutions address key challenges, including the need for more affordable and sustainable housing and to reduce the environmental impact of construction amidst a labor and skills shortage.

ABB Robotics automation offers huge potential to enhance productivity, efficiency, and manufacturing flexibility throughout the construction industry. As well as making the industry safer and more cost effective, robots are improving sustainability and reducing environmental impact by enhancing quality and cutting waste.

“When it comes to robotics, what is needed are simple, long-lasting and reliable solutions.”

Phillipe Fleischmann,
Technician, Robotics
at ETH Zurich / Robotics
Fabrication Lab.

Phillipe Fleischmann, the technician responsible for robotics at ETH Zurich / Robotic Fabrication Lab has been working for years with robots equipped with PMA's cable protection solutions: “I know PMA's cable protection solutions from previous projects; I have particularly positive recollections of using them. To me, it was the obvious thing to use PMA's cable protection products again for this new ETH project.”

The cable protection solutions developed by PMA for automation applications satisfy the demanding mechanical requirements in key aspects.

“This is why we have equipped the robots used for this project with the **PMA XR-90 multi-layer corrugated conduit**, a product which we can also re-use as our robotics solutions change.”

Robots can dramatically reduce waste in the construction industry by enhancing quality and consistency. About 25 percent of the building material transported to a construction site leaves as waste. With robotics and digital solutions, you can design waste out at the beginning of a project through effective building design and construction processes.

Using robots allows architects to explore new methods of creating more affordable and environmentally friendly buildings.

The Construction Segment, within General Industry Business Line, is growing rapidly, giving ABB tremendous potential to drive a knowledge transfer from a broad range of sectors with new robotics solutions.





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The DFAB HOUSE is a three-storey residential unit built on top of Empa's and Eawag's NEST research and innovation building in Dübendorf.

“The abrasion indicator allows maintenance to be scheduled without incurring lengthy production downtimes.”

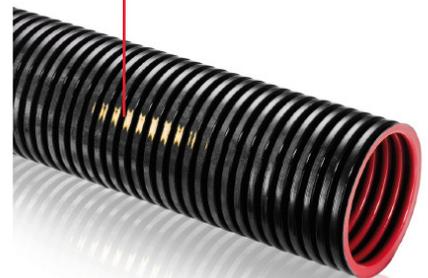


Firdes Arikan, PMA's Sales Manager stated. “Safety and continuity are at the heart of all production processes. Manufacturing companies rely on reliable, high-quality technology to ensure that their installations are safe while, at the same time, optimising maintenance and operating costs. By employing the XR-90 multi-layer corrugated conduit, we were able to make a valuable contribution to these innovative ETH projects. The XR-90 multi-layer corrugated conduit's abrasion indicator allows the production department to schedule maintenance without incurring any lengthy downtime.”

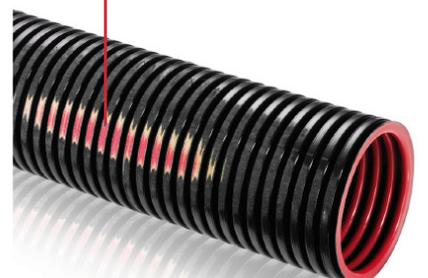
The **XR-90 multi-layer** corrugated conduit possesses excellent abrasion resistance; it also has a visual wear indicator composed of three different coloured, specially formulated polyamide layers which show how much wear has occurred. To begin with, the corrugated conduit is black; as it becomes worn, the yellow layer appears, allowing maintenance to be planned in advance. When the red layer eventually appears, a replacement conduit can be made available and replaced, minimising maintenance and downtime. Using XR-90 multi-layer corrugated conduits allows downtimes and spare parts costs to be reduced.



Centre layer showing up as yellow
The first indication of abrasion; plan for upcoming maintenance.



Inner layer showing up as red
Second indication of abrasion; have maintenance carried out now to avoid a lengthy production downtime





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A complete cable protection system for automation solutions: specially designed conduits, clamps and abrasion protection sleeves provide highly effective protection for all moving parts, massively reducing torsional forces.

DFAB HOUSE

The DFAB HOUSE is the first building in the world to combine several innovative digital construction processes under one roof at the same time. Eight ETH Zurich faculties and industrial partners, including ABB, are involved in the project. To a great extent, the building modules are pre-fabricated by ABB robots in the ETH's Robotic Fabrication Laboratory.

ABB technology is also used for the building automation and energy distribution systems in this ground-breaking structure. A KNX system carries out detailed measurements of the energy flows in the building and optimises them.

ETH Zurich

The Swiss Federal Institute of Technology in Zurich, ETH Zurich for short, is one of the world's leading universities. It was established in 1855 as the Eidgenössisches Polytechnikum (Swiss Federal Polytechnic).

ABB Robotics

ABB is a leading supplier of industrial robots and robot software and also of application equipment and complete manufacturing solutions. ABB Robotics has sites in 53 countries and more than 500,000 robots have been installed throughout the world. ABB Robotics offers the most comprehensive range of services and the largest service network in this sector.

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