

SmartWire-DT®

# Intelligent wiring for machine and system building. Build it in.



**EATON**

*Powering Business Worldwide*

# Reducing complexity for more compact, cost-optimised machines.



Customer expectations today are focused on increased performance in a more compact design, shorter delivery times, and the right price. To meet these requirements, machines need to be built in shorter time frames, using smaller control cabinets with intelligent, energy-saving devices that allow a smaller machine footprint.

SmartWire-DT is a unique wiring solution that streamlines connection and communications inside and outside control panels.

Machine builders globally are finding that SmartWire-DT can be integrated easily into machines in a smaller control cabinet, reducing the time and effort for wiring their machines by up to 85%.



## Reducing wiring costs by 85%



## Simplify wiring. Reduce costs.

Today, control wires are used to connect devices like switchgear or pilot devices to PLC I/O-modules. Using SmartWire-DT, these modules and the control wiring becomes obsolete. All devices are connected to this intelligent wiring system, reducing engineering and installation costs for the machine builder, and optimizing machine maintenance and availability for the customer.

### Less complex, more compact machines

Eliminating the PLC I/O and the control wiring means more compact control panels and machines, and makes automation structures simple to design and configure.

### Simplified connectivity

By replacing conventional, time-consuming control circuit wiring with one single cable, SmartWire-DT enables the simple connection of switchgear in control panels, as well as sensors and actuators outside control panels. This results in safe and error-free switchgear installations combined with significantly shorter commissioning times.

### Higher flexibility

With industrial fieldbus gateways, SmartWire-DT can be connected to PLCs from any manufacturer, giving the machine builder the flexibility to meet customer demand more easily.

### More compact machines with Eaton controllers

For small and medium machines, Eaton offers HMI/PLCs, compact PLC and control relays with integrated SmartWire-DT communication interface. This offers machine builders the opportunity to develop simpler, and even more compact automation solutions.

# Extended communication improves system effectiveness.

Plants need multiple drives, control and pilot devices to be designed, installed and controlled, along with distributed sensors and actuators. Automation of the process environment can be quite challenging, especially if continuous process availability is required. SmartWire-DT is an intelligent wiring system that provides more data on installed devices, central to increased availability and preventive maintenance.

## More data, increased availability

More detailed information enables better process control, more detailed diagnostics, reduced downtime and increased availability. SmartWire-DT switchgear devices provide continuous real-time data information on motor load conditions that allows an interaction before an overload situation occurs and the system stops. Monitoring motor current values also helps with preventive maintenance.

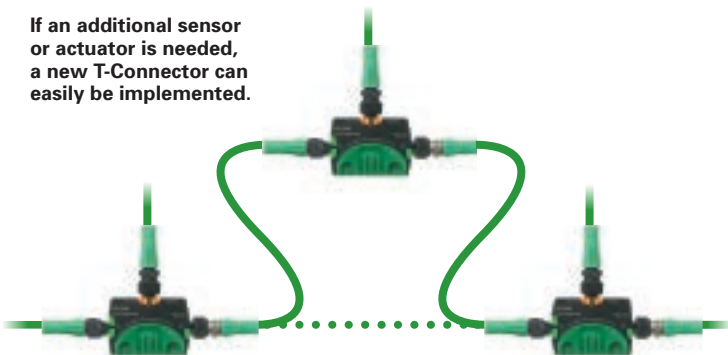
## Compliant to industrial fieldbus standards

With industrial fieldbus gateways, SmartWire-DT can be connected to PLCs from any manufacturer and existing installations can be easily extended.

## Easy expansion

SmartWire-DT makes it easy to add expansions during operation. New devices are simply connected to the communication cable inside or outside the control panel. An overall length of up to 600m simplifies distributed control architectures.

**If an additional sensor or actuator is needed, a new T-Connector can easily be implemented.**



Optimized  
availability  
increases  
profitability

Compliant to  
all industrial  
fieldbus  
standards

Up to 99  
devices  
installed  
along 600m

#### **Intelligent devices at the heart of Industrie 4.0**

Intelligent devices and open communication standards are essential to solutions true to an Industrie 4.0 vision. They have to be able to communicate with every controller within an open architecture while also controlling specific distributed processes independently.

With its SmartWire-DT platform and intelligent devices, Eaton brings the vision of Industrie 4.0 to life. These intelligent devices help engineers to run their businesses on a lean, smart and efficient basis and take another step toward implementing complete Industrie 4.0 solutions.



#### **Intelligent Motor Control Centre with SmartWire-DT®**

With motor control centers, SmartWire-DT replaces all control wiring in the corresponding withdrawable units. Mounting is simplified, wiring reduced and space saved. The information the MCC delivers with SmartWire-DT helps minimise system downtime.

# One system, countless possibilities.

SmartWire-DT enables distributed intelligence that changes automation. Interface modules installed on standard switchgear replace the digital and analog I/O layer on PLCs. Gateways to any industrial fieldbus make it not just possible, but simple to access the SmartWire-DT network independent of the PLC system. At the same time, SmartWire-DT technology is available as an integrated part of our controllers. The result: easy-to-configure, linear automation structures with few components.

## Powerful technology

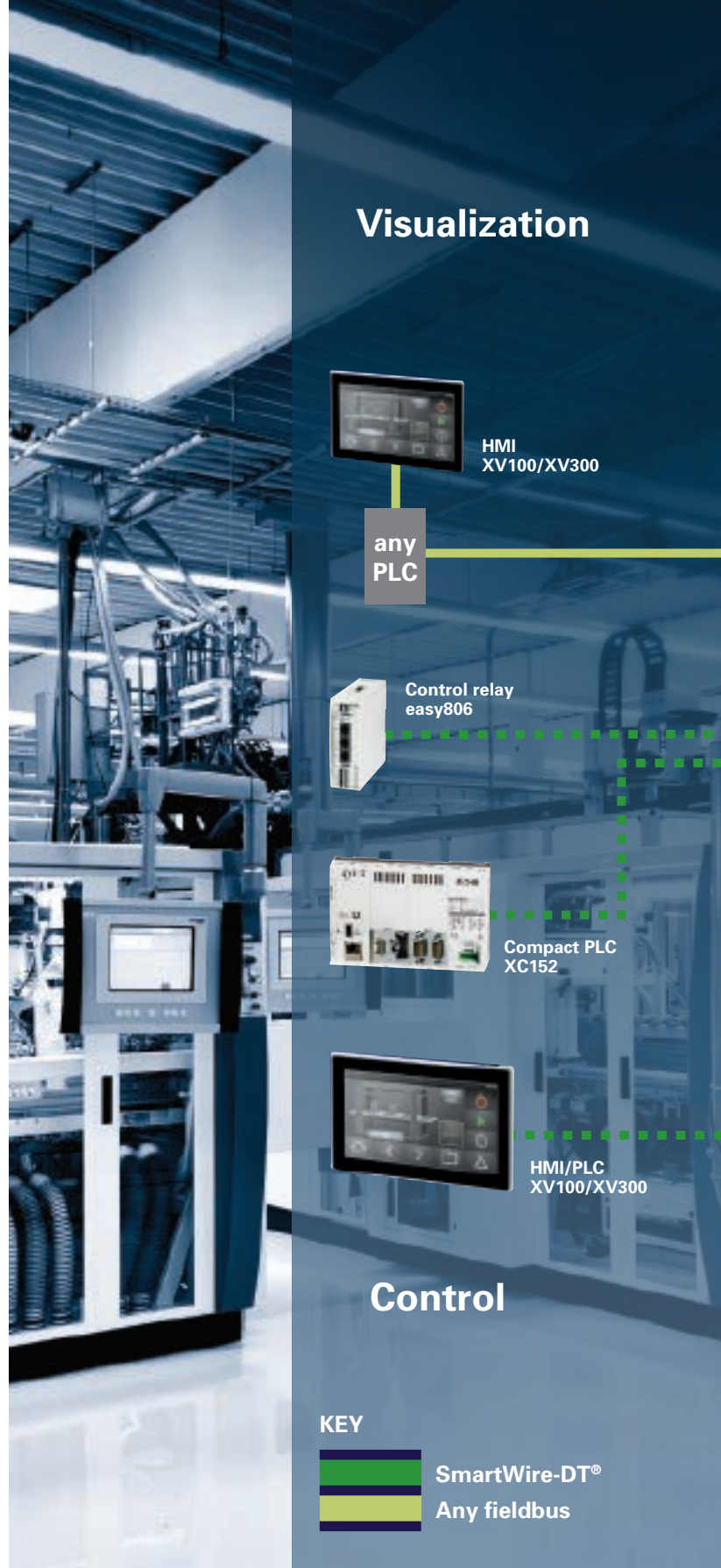
Up to 99 devices can be connected on a single SmartWire-DT line. The maximum permissible total length is 600m, while the maximum data volume for cyclic process data is 1,000 bytes. The SmartWire-DT cable also includes the required power supply for the SmartWire-DT electronics as well as for installed contactors.

## Flexible integration in every automation environment

Fieldbus gateways are used to connect the SmartWire-DT communication system to your individual PLC system. SmartWire-DT can communicate via industrial fieldbus using standardised mechanisms for configuring and parameter setting.

## SmartWire-DT modules

Two different types of SmartWire-DT modules are available. Special function modules replace the electrical interfaces of contactors, pushbuttons, pilot devices and auxiliary switches. Intelligent devices like electronic motor protective devices, softstarters and drives transmit digital and analog information (e.g. current, overload..) directly onto the SmartWire-DT network.



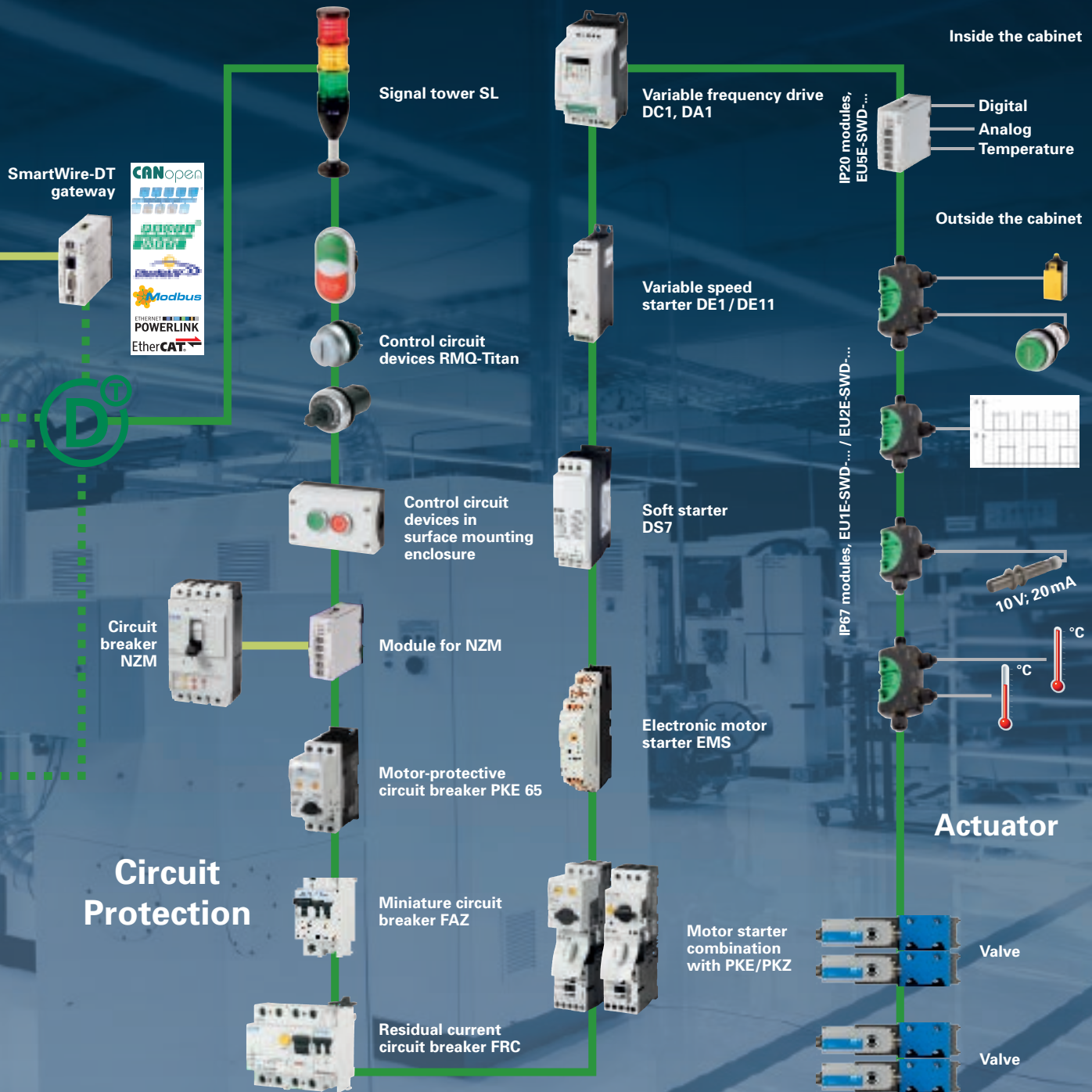
## Inside and outside the cabinet

Smartwire-DT can also be used to directly connect sensors and actuators in the field. This is done with T-Connectors, available as digital and analog I/O modules with an IP67 degree of protection.

## Operate

## Start a motor

## Input/Output



## Circuit Protection



### Electrical and Hydraulic

Special dedicated SmartWire-DT modules can be used to directly control 2/3-position or proportional hydraulic valves.

# Our products

## Control and visualization

Product	HMI/PLC XV100/XV300	Compact PLC	easy800 control relays
			
<p><b>Product description</b></p>	<p>XV100/300 is a range of products consisting of HMI devices with an integrated PLC (HMI/PLC) and a variety of sizes and equipment options. These high-performance devices come with powerful graphics processing units that allow for a highly responsive, state-of-the-art user interface and the integration of multimedia elements such as video, PDF, and web contents.</p>	<p>Our XC-152 compact PLC combines plenty of processing power with a large number of communication interfaces. This makes the device particularly well suited to standardized automation solution applications in the field of modular machine building.</p>	<p>The easy800 control relay, featuring an integrated SmartWire-DT master, is able to directly access analog and digital data from SmartWire-DT modules. As a result, switching states, status messages, motor load currents, and module diagnostic data can all be easily processed in the corresponding circuit diagram.</p>
<p><b>Technical features and characteristics</b></p>	<ul style="list-style-type: none"> <li>• Bright 3.5"–10.4" TFT displays with high resolution and 64K color; available in plastic or metal housings</li> <li>• 7"–10.1" multi-touch devices with a toughened, anti-glare glass panel</li> <li>• Interfaces: Ethernet, USB Host 2.0, USB Device, RS232, RS485, CAN, Profibus, SmartWire-DT</li> <li>• Programming with CODESYS/Galileo with CODESYS-2 and CODESYS-3</li> </ul>	<ul style="list-style-type: none"> <li>• Compact PLC with Windows CE 5.0 operating system</li> <li>• Interfaces: Ethernet, USB Host 2.0, USB Device, RS232, RS485, CANopen/easyNet, PROFIBUS-DP, SmartWire-DT</li> <li>• Integrated web server</li> <li>• Programmable with CODESYS-2 and CODESYS-3</li> <li>• Galileo remote visualization</li> </ul>	<p>Control relays available in two versions:</p> <ul style="list-style-type: none"> <li>• With SmartWire-DT</li> <li>• Additionally, with easyNet and 4 fast inputs (2 usable as fast outputs)</li> </ul>
<p><b>Function via SmartWire-DT</b></p>	<ul style="list-style-type: none"> <li>• Connection of up to 99 SmartWire-DT modules</li> <li>• Up to 1 kB of cyclical process data</li> </ul>	<ul style="list-style-type: none"> <li>• Connection of up to 99 SmartWire-DT modules</li> <li>• Up to 1 kB of cyclical process data</li> </ul>	<ul style="list-style-type: none"> <li>• Connection of up to 99 SmartWire-DT modules</li> <li>• Up to 166 inputs/outputs</li> </ul>



## Operate

### Field bus gateways



Field bus gateways can be used to connect SmartWire-DT modules to any industrial field bus system. Well-established mechanisms, such as field bus description files, are used to configure SmartWire-DT modules in the programming system's PLC configurator.

Gateways for connecting to industrial field bus protocols:

- Profibus-DP
- CANopen
- Modbus-TCP
- EthernetIP
- Profinet
- Powerlink
- Ethercat
- Automatic addressing of the connected SmartWire-DT devices
- Separate diagnostics interface

- Connection of up to 99 SmartWire-DT modules<sup>1)</sup>
- Up to 1 kB of cyclical process data<sup>1)</sup>

<sup>1)</sup> Depending on the field bus protocol used

### RMQ-Titan pilot devices, SL signal tower



RMQ-Titan is a comprehensive range of pilot devices. The use of SmartWire-DT communication modules eliminates the need for the control wiring traditionally required for these devices. This applies to SL signal towers as well.

RMQ-Titan actuator

- Switches, pushbuttons, indicator lights available in various colors, illuminated pushbutton actuators, selector switches, potentiometers, encoders
- Degree of protection IP67

Signal tower:

- 2 sizes: 40, 70 mm
- Up to five modules can be combined
- Lamp modules (LEDs, filament lamps) available in six colors
- Acoustic module
- Degree of protection IP66

- Pushbutton / switch status
- Contact monitoring
- Driving indicator lights
- Driving the lamp modules in SL signal towers
- Analog value for potentiometers

### Contactors, PKZ motor starters



The two-component motor starter, made up of a DILM contactor and a PKZ motor-protective circuit-breaker, is rated for rated operational currents of up to 15 A and features plug-in terminals that make it easy to replace components. Moreover, motor starters rated for currents of up to 32 A can be quickly assembled without any errors by using assembly connectors.

- Performance range: 0.06 - 15 kW with 400 V
- Voltage range 220 - 690 V
- Two independent separate contact systems in the motor starter

- Contactor actuation and feedback
- Connection for trip block auxiliary contacts
- On-site operation (manual/automatic)
- Powering the contactor

### PKE Motor starter, PKE circuit breakers



The PKE is a motor-protective and system-protective circuit breaker with modular trip blocks and an electronically implemented overload protection feature. The two component motor starter, made up of a DILM contactor and a PKE motor-protective circuit breaker, is rated for rated operational currents of up to 15 A and features plug-in terminals that make it easy to replace components.

- 0.06 - 15 kW with 400 V
- Wide-range overload protection
- Variable CLASS setting 5 to 20
- Plug-in trip blocks for motor and system protection
- Overload relay function (optional)

- Messages with load currents
- Trip block state
- Detailed trip reasons (e.g., phase failure),
- Reading back the settings for overload current
- On-site operation (manual/automatic)

# Switching, protecting and driving motors

## Electronic motor starter EMS



This electronic motor starter for two operating directions, featuring integrated motor protection, is suitable for three-phase motors with a rated output of up to 3 kW and is perfect as a universal motor starter for small drive systems in standard and safety applications.

- Performance range 0.06 - 3 kW with 400 V
- Voltage range 42 - 500 V
- Compact: 30 mm width
- Hybrid switching technology with 30 million switching operations
- Push-in terminal type
- Integrated reversing starter function
- Integrated emergency stop function up to SIL3
- Wide-range overload protection

- Driving the motor
- Messages with motor current, load status, detailed trip reasons (e.g., phase failure)
- Reading back the settings for overload current

## DS7 soft starters



The soft starter DS7 is ideal for pumps, fans and small conveyor applications. It is a fully integral element in the xStart system. DS7 units not only replace the mechanical contactor, but also add a "soft motor startup" function to it. Extended service intervals and reduced operating.

- Gentle, smooth motor/pump start, up to 110 kW
- Contactless switching, rapid and noiseless actuation
- Perfect overload protection thanks to the PKE motor-protective circuit breaker
- Version with minimum temperature of -40 °C

- Driving the motor
- Setting parameters such as ramp times
- Detailed additional information and fault states
- Powering the soft starter

## PowerXL DE1 variable speed starter



In its role as a variable speed starter, the new PowerXL™ DE1 closes the gap between conventional motor starters and variable frequency drives by combining the advantages of both – the ease of use of a motor starter and the variable motor speed of a variable frequency drive – at an affordable price and with an outstanding level of reliability.

- Speed control up to 7.5 kW
- Commissioning without parameterization
- No special drives engineering skills or knowledge
- Can be used to replace contactors, motor starters, reversing starters and soft starters in applications with a constant frequency below or above the supply frequency, a variable motor speed, and an inrush current with a magnitude equal to that of the motor's rated operational current

- Driving the motor
- Setting parameters such as speed, ramp times, max. motor current, motor voltage, etc.
- Detailed additional information and fault states

## PowerXL DC1, DA1 variable frequency drives



The compact PowerXL™ DC1 variable frequency drive for standard applications can be configured and put into operation quickly and easily. PowerXL™ DA1 variable frequency drives, designed for machine building, are available with a wide variety of communication protocols. In addition, an integrated function block editor and a powerful vector control mode make them perfect for highly dynamic applications.

- Speed control up to 250 kW
- U/f and vector control (SLV, CLV)
- DA1 with 200% torque at 0 rpm
- Integrated EMC filter
- DA1 with integrated function block editor and STO (Safe Torque Off)
- CANopen and Modbus RTU on board
- Degrees of protection: IP20, IP55 (DA1) and IP66

- Driving the motor
- Setting parameters such as speed, ramp times, max. motor current, motor voltage, etc.
- Detailed additional information and fault states

## Circuit Protection

## Connecting

### Digital residual current circuit breakers. Miniature circuit breakers



Miniature circuit breakers and residual current circuit breakers for faults and additional protection, featuring digital functions designed to improve system availability. These digital functions include a warning system that makes it possible to detect gradual faults early on. Type A, B, and B+ digital devices are available.

- Rated operational current: MCB up to 125 A Digital RCCB up to 80 A
- Rated operating voltage: MCB up to 277/480VAC Digital RCCB up to 240/415 VAC
- Rated frequency: 50 Hz
- Rated tripping current: Digital RCB up to 300 mA
- Sensitivity: The digital RCCBs are available as Type A, B and B+
- Braking capacity MCB up to 25 kA

- Circuit breaker status
- Trip indication

### NZM circuit breakers



With one single product family, NZM circuit breakers provide reliable overload and short-circuit protection for systems, generators, transformers, and motors. Their comprehensive accessories, global type approvals and listings, and worldwide availability make them the ideal choice for demanding protection requirements in the machine and system building industry.

- 4 sizes up to 1600 A
- Voltages up to 1000 VAC and 1500 VDC
- Switching capacity from 25 kA up to 150 kA
- Thermal magnetic and electronic trip blocks
- Available as switch disconnectors, main switches, and emergency stop switches

- Indicating load currents, advance overload warning, detailed trip reasons (e.g., ground fault)
- Reading back the settings for overload current, etc.
- Power meter (SO)
- Connecting a remote switch unit

### XNH fuse switch-disconnectors



XNH fuse switch-disconnectors feature a much wider range of safety functions than that required by the IEC/EN 60947-3 standard. Moreover, a large number of device versions and comprehensive accessory options ensure that these units can be used in a broad range of applications. These characteristics, combined with outstanding ease of installation, make it easy to implement projects safely and in a cost effective manner.

- Basic device with flat or box terminal
- FCL fuse monitoring with LED
- Electronic FCE fuse monitoring
- Mounting options: 60 mm busbars, mounting plates, DIN-rails
- Electricity theft protection guard
- Can be locked with a padlock
- Switch cover for maintenance work in safe holding position
- 1, 2, 3 and 4 pole up to 630 A
- Can be used with NH000, NH00, NH1, NH2, and NH3 fuse-links.

- Disconnector status (open, closed)
- Fuse tripped
- Providing information on instantaneous load currents

### I/O modules



Digital and analog input/output modules: Featuring an IP20 degree of protection when used to integrate conventional actuators and sensors in a control panel or an IP67 degree of protection when directly installed on the sensors/actuators on a machine.

- Module versions with:
- Digital inputs, digital outputs, digital inputs/outputs
  - Analog inputs (0 - 10 V, 0 - 20 mA, temperature), analog outputs (0 - 10 V, 0 - 20 mA)
  - Counter input

- Reading and writing digital and analog values
- Setting parameters
- Diagnostics information

# SmartWire-DT<sup>®</sup> in system applications.



## Putting power into potato-sorting

SmartWire-DT<sup>®</sup> helps to increase productivity and uptime and simplify maintenance for end users, reducing engineering time and increasing flexibility when designing, installing and commissioning plant.

**Background:** German company Schaltanlagenbau Gormanns GmbH was responsible for the electrical power supply and drives in a fully automated potato sorting plant that was part of an extensive new building project.

**Challenge:** The plant, designed to process 120 tons of potatoes per hour, had to be up and running on time for harvesting season and needed to be simple to operate. The project required the installation of 250 drives for conveyor belts, pumps, fans and machines as well as 50 command points.

**Solution:** Eaton's SmartWire-DT intelligent wiring system meant project completion in just four months, with wiring reduced to an eighth of a conventional wiring solution. Cross wiring was reduced from 1km to 50m, and the cabling required for the control circuit devices on the machines reduced by around 40%.



### Results

"I was sceptical about whether SmartWire-DT could do what it promised," says Sebastian Gormanns, Managing Director at Schaltanlagenbau Gormanns GmbH. "I have seldom seen anything so simple. Instead of the two weeks required for commissioning our previous sorting plant project, we only needed 1.5 days with this project. And when a problem comes up, we can explore the system remotely, diagnose and correct it."



**Background:** Acque del Basso Livenza S.p.A. runs one of the largest purification plants in Italy, serving over 140,000 customers in nineteen municipalities. The company has always been committed to offering its customers a high standard of service efficiency and quality, as well as facing the challenges posed by recent liberalization of water supply services and the resulting competition.

**Challenge:** The plant is entirely automated and operates in a continuous cycle. So whenever one of the motors or pumps in a plant malfunctions, off-site technicians need to be notified of the event and need to be on call 24 hours a day. Problems reduce overall plant productivity and involve considerable personnel management costs.

**Solution:** Using SmartWire-DT, the company can remotely control each single piece of machinery in the plant. A remote connection via VNC enables technicians to monitor in real-time the amount of current absorbed by each motor and, in the event of overload or a technical stop, immediately re-energise the motor simply by tapping the screen of a tablet or smartphone.

### Results

The new system has radically changed plant management for the company in terms of efficiency, productivity and personnel management costs.



**Background:** Austrian contractor Keckeis was engaged to upgrade a crusher and screening plant operating in harsh conditions that undermined optimal productivity.

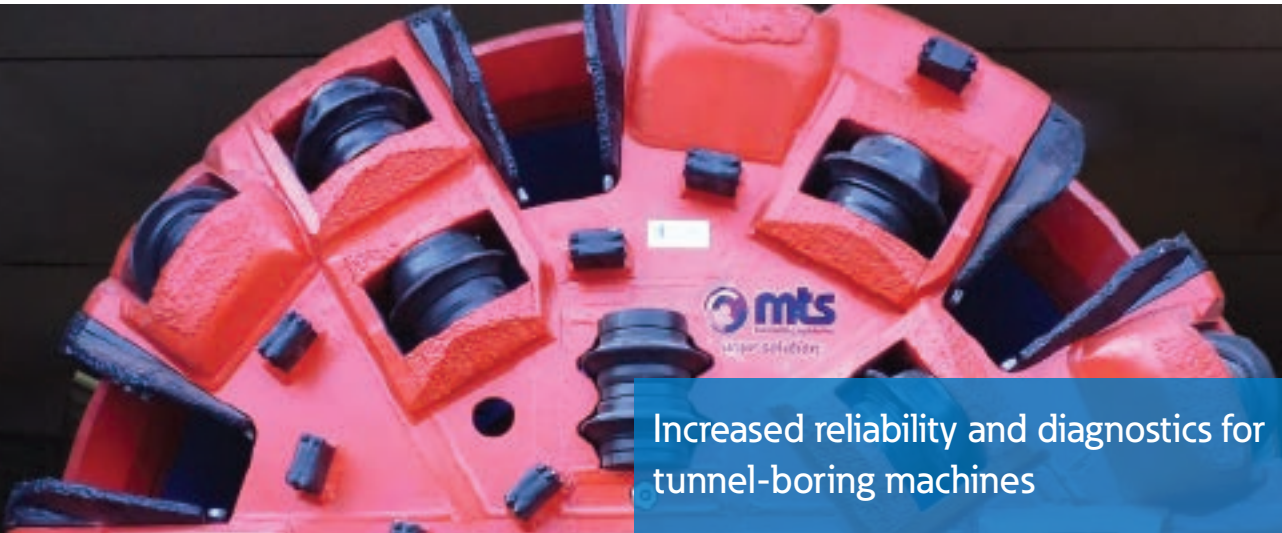
**Challenge:** When starting iced-up elevating conveyors in cold temperatures, frozen water in the belt pockets can cause motor currents to overload, shutting down the conveyor and requiring a restart.

**Solution:** After upgrading the sand and gravel plant with SmartWire-DT, the iced up belt can be automated to 'run warm' until the operating current has dropped to 'idle running', and only then is material conveying enabled. Accidental material conveying and excessive warm running are prevented. A far greater benefit is the controlled operation of the plant close to its maximum output limit for optimized and safe plant operation.

### Results

"Using SmartWire-DT in combination with Eaton's PKE electronic motor protection has not only paid for itself very quickly in terms of investment but also in terms in system availability. As well as the neat and extremely fast wiring of SmartWire-DT, its space-saving design was ideal for the limited space available in the control room," says Manfred Keckeis, general manager at Keckeis Elektrotechnik.

# SmartWire-DT® in machine applications.



Increased reliability and diagnostics for tunnel-boring machines

SmartWire-DT® can help to reduce installation cost by up to 85%, increase commercial flexibility and machine availability whilst providing MOEMs and customers with rich data from their machines, leading to intelligent decision-making that maximizes the potential from Industrie 4.0.

**Background:** German company mts Perforator develops and manufactures tunnel-boring machines for trenchless pipe jacking of supply and disposal tunnels, as deep as 40m below the ground.

**Challenge:** In remote underground environments, where precision and reliability of operation are vital, conventional point-to-point control wiring of components such as switching devices, sensors and actuators carries the risk of errors and malfunctions.

**Solution:** Using SmartWire-DT, mts benefits from a considerably faster assembly, fewer errors and less risk of manipulation, along with detailed remote diagnostic functions. The combination of PKE and SmartWire-DT delivers enhanced drive monitoring, with process-relevant data monitored continuously and analyzed without costly analog I/O technology.



## Results

The company is able to monitor the current states of the 50 tunnelling machines presently in operation worldwide. It can quickly carry out remote diagnostics in the event of a fault, provide a solution and ensure improved system availability for end customers. "Eaton's smart devices enable us to implement detailed data access worldwide down to the field level," says Norbert Simdon, working in electronic support at mts.



## Cleaner wiring solution

**Background:** US-based Renegade Parts Washers manufactures heavy-duty parts washing machines for numerous applications. Founded in 1996, the company has grown from offering a single solution to now having the capability to manufacture customized solutions built to their customers' specifications.

**Challenge:** Customers depend on a solution that will quickly and efficiently clean a high volume of parts and demand the shortest lead time between production and final end-user installation. With the increasing complexity of its machines, Renegade was looking for ways to optimize its production processes.

**Solution:** A machine control system based on the SmartWire-DT communication system cut wiring time, improved flexibility, and supported the implementation of advanced diagnostic features. This meant simpler machines at a lower cost and with added functionality. Extension up to 600m outside the control panel also allowed the connection of sensors and other machine-mounted devices.

### Results

"SmartWire-DT has transformed our control systems," says Dave Barney, owner of Renegade Parts Washers. "It has allowed us to cut our wiring times while improving the flexibility of our systems and adding advanced diagnostic facilities that are a big selling point when we talk to our customers. We'll certainly be using SmartWire-DT on all of the automated machines we build in the future."



## Packed with benefits

**Background:** Macchi SpA is a leading Italian manufacturer of plastics processing equipment. The company produces plastic stretch-wrap film widely used for packaging in almost every industry, typically for wrapping pallets loaded with products.

**Challenge:** Macchi needed to develop a control system for the extruders, coil winders and cutters on a sophisticated new film-manufacturing machine that helps to cut end user costs and delivers significant environmental advantages through using less film.

**Solution:** SmartWire-DT wiring technology brings important benefits, including a smaller control cabinet, reduced wiring complexity and easier testing. Significant time savings in the manufacture, testing and commissioning of the machine were achieved, and the flexibility of the SmartWire-DT system makes it easy to incorporate future upgrades and modifications.

### Results

"The project has been a great success," says Mauro Andreoli, Sales Manager at Macchi. "We expect to be using SmartWire-DT technology again in the very near future, and consider it to be a big and very important step forward in control system technology."

## Better solutions for machine builders worldwide

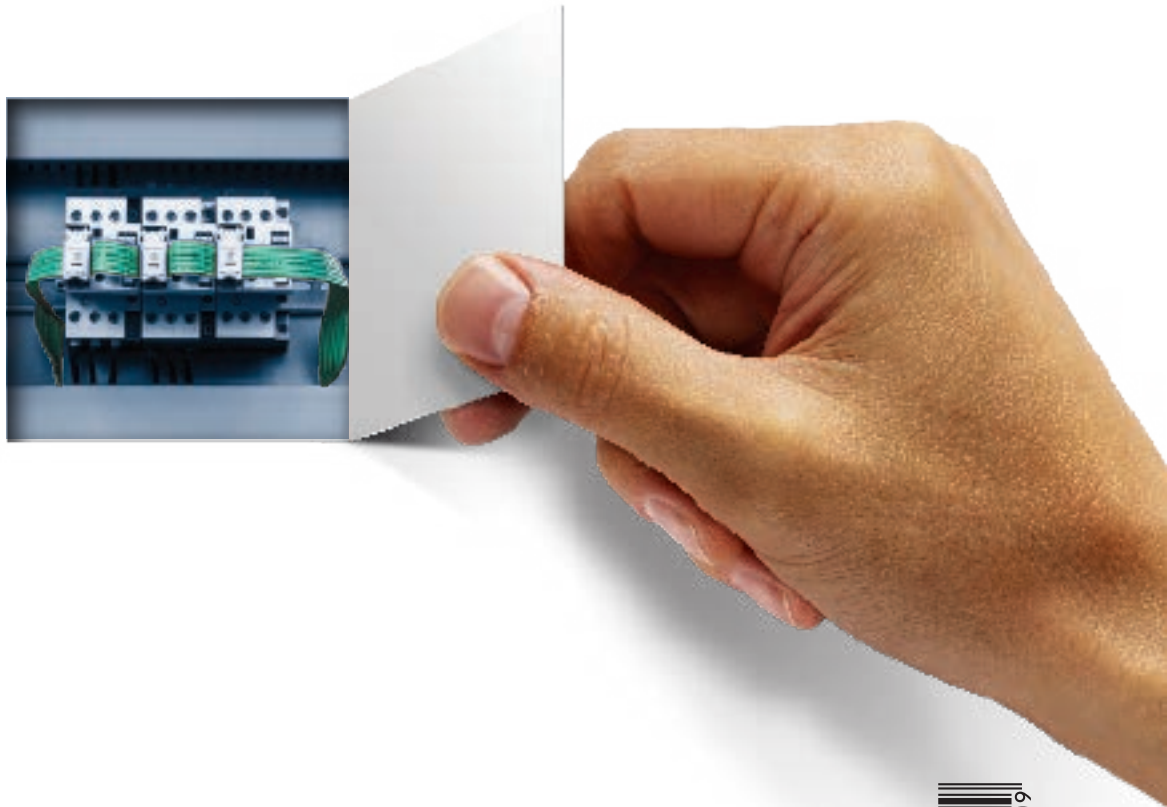
At Eaton, we provide compact and complex machine and system solutions for the world market.

These solutions are focused on helping end users to make tangible improvements in productivity and profitability with machines that are:

- Simpler, more compact and lower cost
- More reliable
- More energy-efficient
- Safer

We serve the electrical engineering of all parts of a machine. Our circuit protection solutions help to better protect people and assets. Our SmartWire-DT intelligent wiring system enables users to connect electrical and hydraulic devices, from controllers to sensors, reducing costs and increasing uptime. Our ergonomic human machine interfaces ranging from a reliable push button up to a innovative multi-touch HMI/PLC offer best in class solutions to operate and control. Finally our modern motor starter and drive solution for safer, more reliable and energy-efficient operation.

For more information, visit [www.eaton.eu/electrical](http://www.eaton.eu/electrical)



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