

White Paper

## Four big advantages of deploying digitalization and IoT connectivity in industrial doors for machines and plants

### Abstract

Simple, safe, and reliable operation of industrial doors – on both machines and throughout plants – can ensure smooth, efficient workflows that avoid disruptions and mishaps. Modern door automation and control systems, such as Siemens SIDOOR with advanced intelligence and IoT connectivity, can facilitate machine and plant digitalization and provide retrofits for outdated, complex, and hard-to-maintain pneumatic and hydraulic door systems.

When stories are told of how digitalization is transforming industries, chances are artificial intelligence, advanced data analytics, cloud platforms, and the Industrial Internet of Things (IIoT) will be mentioned, as they should be. But the stories will likely overlook the role of the automation and control of protective doors for machines as well as doors and gates for managing safe and secure access, ingress, and egress in plant facilities.

After all, the proper functioning and reliable operation of industrial doors on machines and in plants are key factors in the digitalization of modern manufacturing and process production. These factors are integral to the efficiency, productivity, and safety of both the workers and capital equipment that drive the workflows and, ultimately, the profitability of industrial enterprises. In recent years, digitalization has enhanced all of them dramatically.

This paper helps readers who are responsible for OEM machine and plant design, and engineering to better understand the latest technology advancements in door automation and control, so they can expand their options for new-build opportunities as well as for upgrades and retrofits of existing equipment and plants. It describes the Siemens SIDOOR portfolio of standards-based solutions for machine tool doors, safety gates, and lift and roller gates, including their connectivity to higher-level systems and, literally, their exclusive one-button commissioning. Siemens also offers SIDOOR solutions for elevators and for mobility applications, such as mass transit trains.

### Outdated door automation and control technologies can be costly

For decades, industrial door automation and control solutions have often relied on relatively complex and costly hydraulic or pneumatic drive schemes. The former requires long lengths of fluid tubing and servo motors to operate, while the latter needs air tubing and motorized air compressors to function.

Of course, both systems have their periodic maintenance demands, which can increase with age and add cost to plant operations and increase the number of OEM technician truck rolls to service their equipment. But, also with age comes the difficulty of finding replacement parts and repair know-how as components wear out. And any time a door to a machine or inside a plant doesn't function as it should, workflows can be disrupted, impacting efficiencies, productivity, and outputs.

In contrast, SIDOOR automatic door controls provide compact digital components – powerful electric motors, high-efficiency power supplies, and intelligent controllers with built-in connectivity – all built with solid-state electronic reliability and ruggedized for extreme reliability in industrial environments.

These same SIDOOR automation and control systems are used in sophisticated elevator systems that carry people safely between floors of some of the world's tallest buildings and also to automate the safe operation of door openings and closings in mass transit systems around the world. In continuous testing, SIDOOR systems have surpassed more

than 1 million door cycles, so their reliability is proven both in Siemens testing labs and in actual use.

In addition to matching accessories, such as belt deflector units, mounting brackets, and door clutch holders, the SIDOOR industrial portfolio features the following core components:

- SIDOOR M-Series and MDG-Series industrial motors:** The M-Series can handle doors weighing up to 600 kg with speeds up to 500 mm/s and IP40 and IP54 protection. They operate with a pre-assembled, 56 mm pulley shafts and toothed belts. The MGD-Series can operate doors weighing up to 700 kg at speeds up to 1499 mm/s and come with IP56 protection. NMS (neutral mechanical solution) models are available with optional groove-and-feather key and output shaft on which self-made pinions can be mounted to suit particular applications. This is done by modifying the pitch-circle diameters of the drive pinion (from 28–122 mm) to optimize the force and speed of a door's motion.



- SIDOOR SITOP power supply:** The Siemens SITOP PSU 8200 36V power supply provides extremely high efficiency over 94 percent of its load range and comes with a service life of 70,000 hours. With just a 70 mm module width, it can easily fit into control cabinets, if desired. The cULus-listed power supply is available in 1- and 3-phase models, with the latter supporting 400/500 V AC power throughputs. SIDOOR systems require little power to use, so energy costs are nil.



- SIDOOR intelligent, connected controllers:** These come in four models, depending on their communications capabilities or protocol: relay mode, USS, PROFIBUS, and PROFINET. The relay model is a standalone option and is able to operate autonomously to output “open” and “closed” door positions, as well as a “reversing” state for safe operation.





### Siemens SIDOOR Systems for Elevators and Mobility

Safe and reliable entry and exit of doors isn't just a requirement of industry worldwide, but also of building elevators and mass-transit systems. Siemens SIDOOR systems are in deployed in thousands of high-rise buildings and modern trains and subways, helping their operators ensure that millions of passengers each day reach their destinations safely and on time. To find out more about SIDOOR Elevator or Mobility solutions, visit [usa.siemens.com/sidoor](http://usa.siemens.com/sidoor)

The latter three are programmable in the Siemens TIA (Totally Integrated Automation) Portal, a common software engineering digitalization portfolios. For OEM applications, these controllers can integrate with the Siemens SINUMERIK CNC automation system for machine tools. SIDOOR systems can also be linked to and operated by third-party controllers via PROFINET or PROFIBUS protocols using GSD (General Station Description) files.

The latter three communications protocols also can be programmed to ergonomically operate doors on either OEM machinery or inside plants via impulse or assisted drive. When impulse drive functionality is activated, operators can open, stop, and reclose doors with a light touch. This not only provides a simplified and intuitive operating sequence, but also saves costs because dedicated operating elements, such as open, stop, and

close buttons, can be eliminated. Assisted drive functionality provides workers with motorized operation of heavy doors, saving strain and preventing injury.

Importantly, the SIDOOR controllers can communicate via standard protocols to higher-level plant systems for enhanced automation functionality and control. For example, an automated guided vehicle (AGV) loaded with parts or feedstock can leave a plant's storage warehouse and, as the AGV approaches the assembly or process production, a door to that area can receive a command to open, then close after it safely passes through.

This IoT connectivity can enable other digitalization functions such as the use of digital production twins, which are virtual 3D proxies of entire plant layouts, and of cloud-based analytics for condition-based maintenance of OEM machinery. Doors and gates can also be linked into biometric and badging schemes to enable role-based access or to allow only authorized personnel to enter sensitive or dangerous plant areas.

### Four big advantages of advanced intelligence and IoT connectivity in industrial doors

Siemens SIDOOR automation and control systems offer OEMs and plant operators features and capabilities they may never have had before, thanks to built-in advanced intelligence and IoT connectivity with SIDOOR controllers. Separate or in combination, these features can provide the following four advantages:

#### 1 Application versatility

SIDOOR automation and control systems for industrial doors can be deployed by OEMs for the safe functioning of their machine doors, whether in CNC machine tool cells or other equipment that require the opening and closing of enclosures to isolate work activities and protect personnel from associated potential dangers.

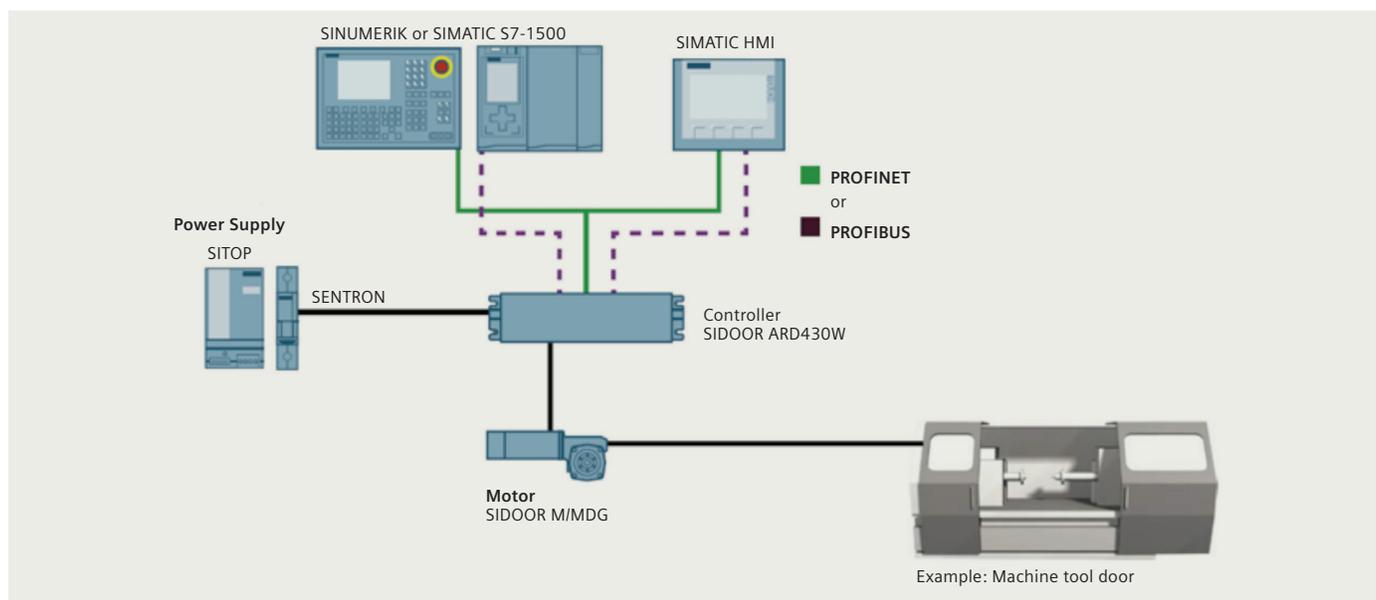


Figure 1. Typical SIDOOR system configuration for OEM machinery.

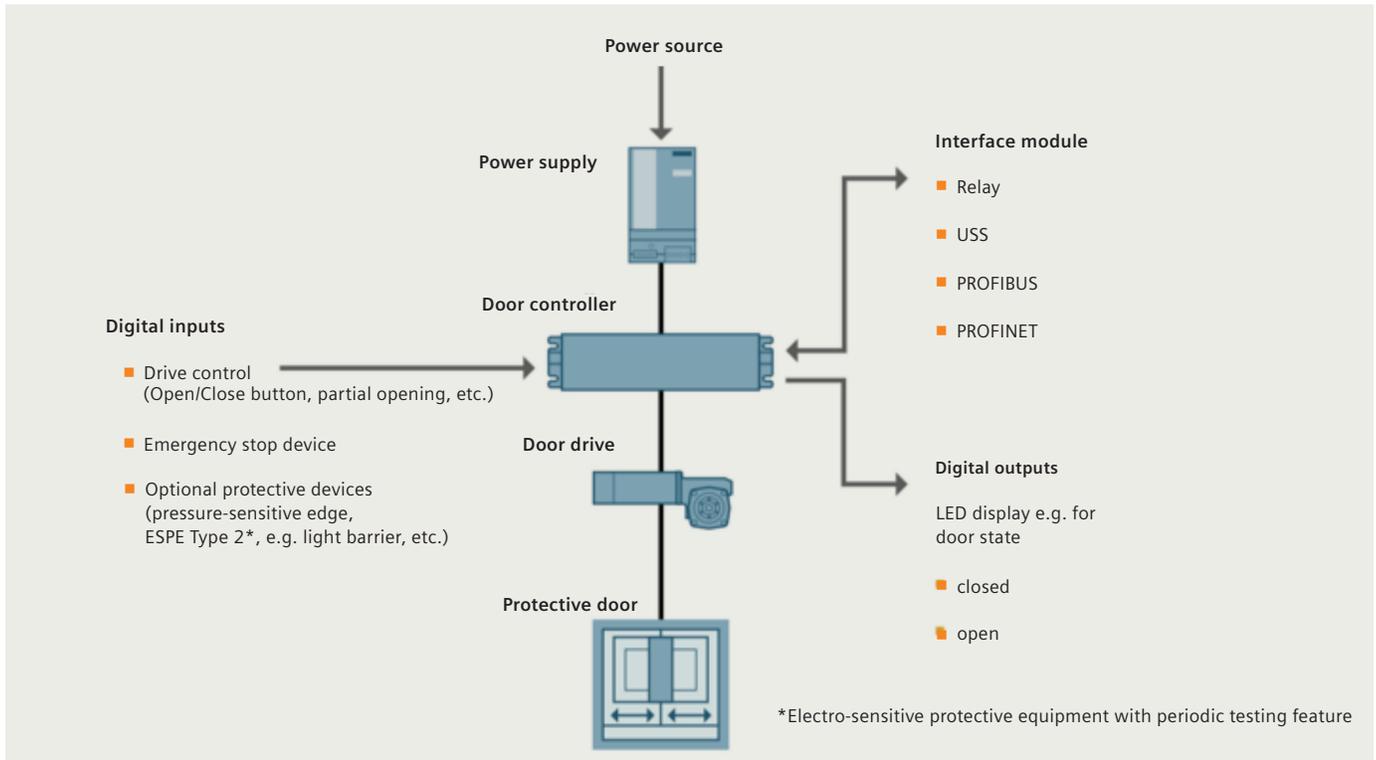


Figure 2. Typical SIDOOR system configuration

What's more, retrofits of existing CNC machines are possible with SIDOOR solutions, especially for applications in which collaborative robots (i.e., "cobots") can load the machines. For automatic or manual loading operations, SIDOOR solutions are directly switchable between fast or standard compliant door movement.

SIDOOR systems can also be used to facilitate the horizontal movements of heavy gates or doors providing ingress and egress from different plant floor areas. Lift and roller gates can also be automated and controlled with a SIDOOR system, which can be installed to be directly switchable between fast or standard-compliant door movement for automatic or manual loading operations. Figure 2 shows a typical plant installation configuration.

SIDOOR automation and control systems with communications functionality can be programmed for operation using the Siemens SIMATIC TIA Portal via a SIMATIC Step 7 function block or, for OEM machines, using the SINUMERIK automation system programming tools. Either approach can provide a much easier and faster way to add intelligence to door operations, whether on a single machine or a fleet of them or all of the doors and lift gates across an entire plant.

## 2 Ease of commissioning

An entire SIDOOR system can be commissioned after installation by pressing a single button on the controller after connecting it to a power source. During a single "teach-in" drive cycle lasting just seconds, the controller acquires all necessary information to set itself up: the motor type; door width; the door end positions; the door weight; and the friction level of its track.



This is a clear advantage of hydraulic and pneumatic door operating solutions, which require a lot of time to conduct trial-and-error configuration. The time savings benefits OEMs, who may offer several protective door variations on different machine models, and plant operators, who are installing new door systems or retrofitting existing ones.

In one case study deployment detailed in the accompanying sidebar at STAMA Maschinenfabrik GmbH, the commissioning time savings were 90 percent compared to pneumatics and 75 percent compared to servo drives.

### Short videos for more information...

See how SIDOOR can provide:

- [Application versatility](#)
- [One-button commissioning works in this short video](#)
- [Safe monitoring of door force](#)

## 3 Digital IoT connectivity

With three bus modes – USS, PROFIBUS, and PROFINET – OEMs and plant engineers can connect their doors to higher-level systems for even greater automation, control, operating visibility, safety, and firmware updates via PROFINET. With digital IoT connectivity, the capabilities and benefits of SIDOOR systems can extend far beyond a plant’s physical footprint and dimensions.

For example, many OEM and plant engineers are already employing digital twins, virtual 3D proxies of their products and production spaces, for design, engineering, commissioning, and operational lifecycle management.

Digital twins can be used to simulate the complete operation, including kinematics and production workflows, of machines and plant environments, to ensure they operate as expected or with changes before committing to the time, expense, and risk of building them in their physical dimensions. With their connectivity, SIDOOR systems can become part of an OEM’s digital machine twin or a plant engineer’s digital production twin.

For plant spaces, digital twins can enable virtual reality headsets to be used to conduct walk-throughs of a digital production twin, saving time and costs compared to traditional approaches to design, engineering, and validation.

Even more, SIDOOR controller models with connectivity features can communicate securely off-premise to Siemens MindSphere, a cloud-based IOT operating system designed specifically for industry. Within MindSphere, a special predictive maintenance MindApp (the name for MindSphere-hosted applications) can keep watch on a particular SIDOOR system’s operation, whether it’s part of an OEM solution or working to open and close industrial doors or lift gates in a plant.

Condition-based maintenance can eliminate more costly schedule-based maintenance. That’s because maintenance intervals can be extended or conducted only when potential issues are identified by the MindApp’s pattern-recognition capabilities enabled by artificial intelligence and machine learning algorithms that can be “trained” to find anomalous operating behaviors. In those cases or if performance KPIs exceed parameter limits, alerts can be issued. OEMs and plant operators can then access diagnostic data, such as

operating hours and reversing operations, to make better, more informed decisions about appropriate and timing of responses.

## 4 Safety

Safety is a paramount design and engineering principle of all Siemens SIDOOR systems. For OEMs, it is important to know that SIDOOR systems comply with safety Performance Level PLd of the “Safety of Machinery” EN ISO 13849 Part 1 standards as well as to EN ISO 14120 (formerly EN 953) machinery safeguards. Testing of electrical safety in accordance with UL61010-1/-2-201. Conformity with these standards has been certified by the German Technical Inspectorate (TÜV).

SIDOOR systems can be easily integrated into facility safety systems. Depending on the system configuration, the connection of an emergency stop (i.e. E-stop) to a SIDOOR system can be made directly or via the higher-level logic in the PLC of the plant’s industrial control system. Siemens has a line of SIMATIC S7 safety integrated PLCs that are especially designed for this type of application, so a separate safety system – with its cost, wiring, and maintenance – is not required.

Additionally, SIDOOR systems can be connected to other plant safety systems, such as light barriers or pressure-sensitive edge sensing systems. Figure 3 shows a typical SIDOOR configuration tied into a plant safety system.

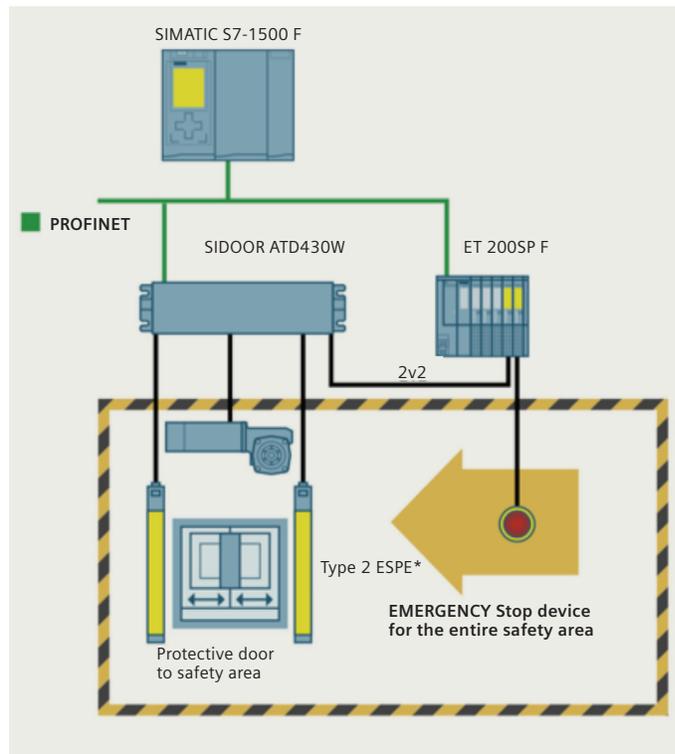


Figure 3. Typical SIDOOR system configuration integrated with a plant safety system via SIMATIC S7-1500 F and ET 200SP F IO, both with safety features built-in.

## Investing in machine and plant simplicity, safety, and efficiency for today and tomorrow

Siemens SIDOOR automation and control systems for doors are proven in diverse applications across industries and globally. These applications include OEM machinery, horizontal and vertical gates and doors, as well as the doors of building elevators and mass transportation systems in some of the world's largest cities. A wide range of high-density electric motors can handle all door types and weights.

Compact and easy to deploy with one-button commissioning, Siemens SIDOOR systems for machine and plant doors are an investment in simplicity, safety, and efficiency both today and in the future. They are suitable for greenfield, new-build requirements and also retrofits of existing infrastructure. The advanced intelligence of SIDOOR controllers coupled with IoT connectivity to higher-level plant systems and even beyond, to cloud-based predictive maintenance analytics residing in the Siemens MindSphere IoT operating system can accelerate the journeys of OEMs and plant operators alike.

### OEM Case Study Snapshot: STAMA Maschinenfabrik GmbH

STAMA Maschinenfabrik produces high-end machine tools, mainly metal machining centers and milling turning centers, for a wide range of industries. Of course, operating safety and efficiency are critical criteria for its many customers. They previously used pneumatic or servo axes to drive the opening and closing of its asymmetrical machinery door leaves. After evaluating newer versions of its existing door automation and control systems as well as competing alternatives, they chose a Siemens SIDOOR digital solution with advanced intelligence and one-button commissioning. After deploying the SIDOOR solution into its machinery, they cut commissioning time by 90 percent compared to pneumatic drives and 75 percent compared to servo axis drives. And, compared to the latter, the company also save 20 percent on its cost. "Siemens SIDOOR provides a complete solution that is a phenomenal unit, that technically and economically perfects the safe and isochronous opening and closing of doors," says Matthias Schwarz, STAMA's head of Control Technology. "Its autonomous door drive with certified torque monitoring is a real marvel in many respects."



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