SIEMENS

Siemens Industry Automation

Totally Integrated Automation

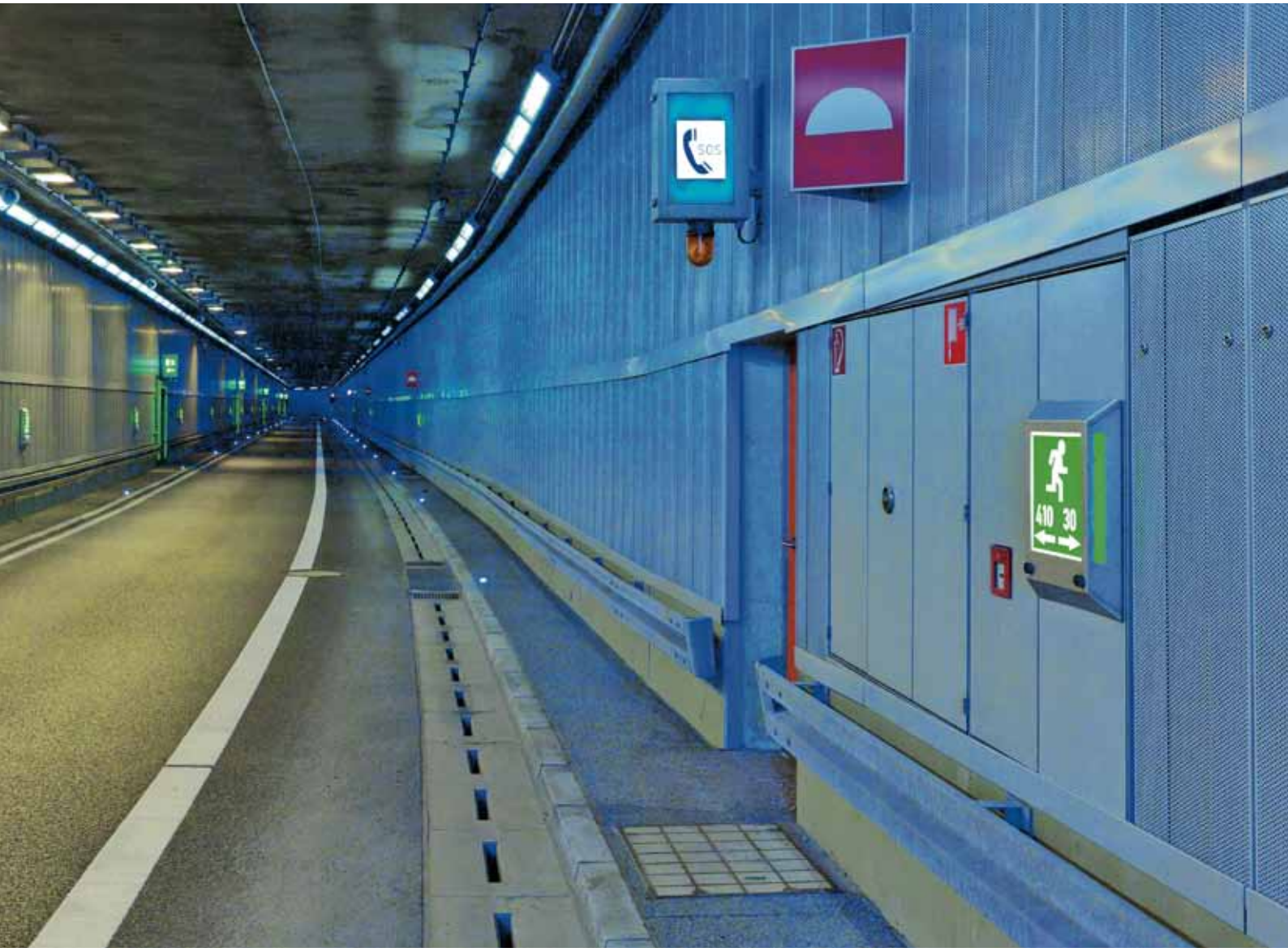
Integrated solutions for tunnel systems

www.siemens.com/tunnelautomation

Integrated solutions for the automation of tunnel systems

The continuing increase in traffic volumes coupled with growing safety requirements demand state-of-the-art tunnel systems. At the same time, equipment requirements for these often huge constructions are rising, especially when it comes to maximum safety and availability. These requirements can be optimally met through Totally Integrated Automation (TIA).

With Totally Integrated Automation, Siemens has been offering a unique, integrated product and system base for the flexible implementation of customer-specific automation solutions from the most varied industries and areas for more than 15 years. This also applies in particular for solutions in tunnel automation.



High availability

Starting with the first planning steps and subsequent dimensioning, Totally Integrated Automation opens up maximum flexibility in engineering the plants. All solutions can be perfectly scaled and optimally adapted to individual requirements. SIMATIC automation components enable redundant control structures that ensure increased availability. This system redundancy allows reliable monitoring and control of the tunnel equipment even if components fail. The fault-tolerant systems (H systems) from Siemens form the optimal solution for every type of tunnel.

Life-cycle costs

From planning and engineering, through installation and commissioning, operation and maintenance, right up to expansion and modernization – consideration of the life-cycle costs is becoming more and more important in tunnel automation - hand-in-hand with long-term investment protection. For this reason, Siemens offers a comprehensive service concept for its components. Long-term spare parts availability for the SIMATIC products is self-evident.

Energy management

As a continuous process, active energy management constantly reduces the energy requirements of the system, thus reducing operating costs and helping the environment. Totally Integrated Automation is the key here. It offers perfect interaction between hardware and software for acquiring, visualizing, and analyzing energy flows. At all automation levels of the tunnel, special programs determine savings potential that can produce sustained and verifiable reductions in energy requirements by means of improved configuration or energy-optimized dimensioning of components and systems.

An overview of Totally Integrated Automation

Totally Integrated Automation represents comprehensive, integrated automation from Siemens. The open system architecture encompasses perfectly coordinated hardware and software with consistent data management, global standards, and uniform interfaces.

Comprehensive automation concepts form the basis for Totally Integrated Automation:

- **Integrated Engineering**
- **Industrial Communication**
- **Industrial Data Management**
- **Industrial Security**
- **Safety Integrated**

The optimal interaction of these concepts allows maximum efficiency and flexibility.

Integrated Engineering

Simplified engineering - optimal flexibility

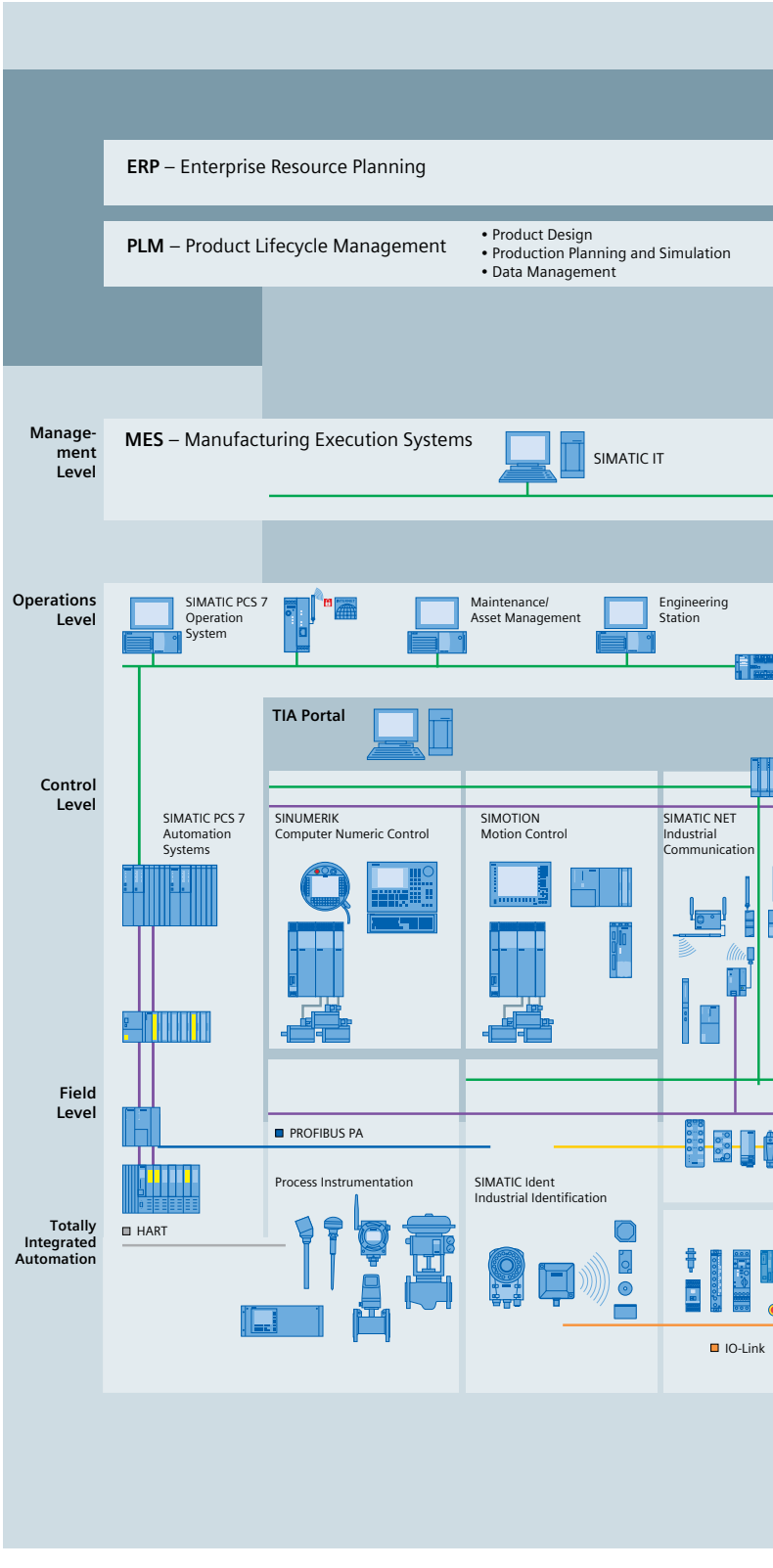
Requirements increase the complexity of tunnel systems and their automation solutions continues to grow. Optimization of the engineering process is therefore an important contribution toward increasing the safety and cost effectiveness of tunnel systems.

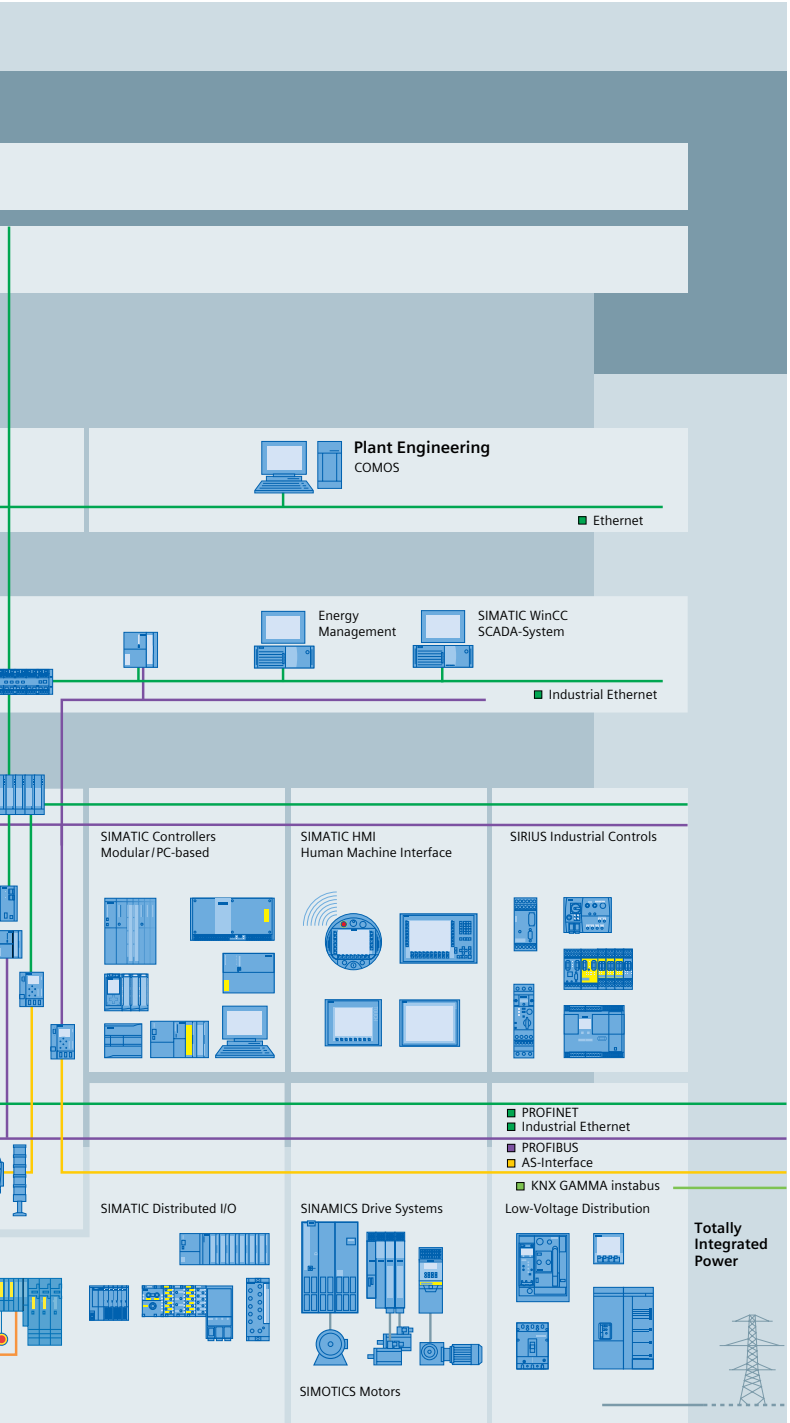
Seamless integration of different engineering tools for parameterizing and commissioning the automation and drives technology helps to create unique efficiency benefits. The basis for this is formed by uniform, intuitive user interfaces and library concepts across all automation objects, as well as a shared database for configuration, communication, and diagnostics.

Industrial Communication

More efficiency on the basis of field-proven standards

Totally Integrated Automation creates the prerequisites for unrestricted integration in communication – and thus for maximum transparency across all levels, from the field and control level, through the plant management level, all the way to the corporate management level. Communication standards such as PROFINET and PROFIBUS are used. The use of SCALANCE network components enables communication even under difficult environmental conditions.





Industrial Data Management

Intelligent and integrated data management

Using the tool "Industrial Data Management" of Totally Integrated Automation, all the important data generated during the productive operation of a plant in the manufacturing and process industry flows into a comprehensive solution - related to the overall plant: along the entire value added chain – across all levels from incoming goods, through production, to outgoing goods – from the field level to the plant and corporate management levels. This data is available in real time wherever it is required. Industrial Data Management thus creates the basis for maximum decision certainty – and thus for the most cost-effective operation of the plant.

Industrial Security

For the tunnel – integrated into the automation solution

With centralized data management in control rooms, increasing amounts of data have to be exchanged across different levels and between different systems. Open Ethernet connections are increasingly used all the way down to the field level. This open communication taps into diverse application options, but it requires reliable protection against unauthorized access. The safety functions integrated into the TIA Portal make it possible to define important safety measures, such as: secure remote access with VPN, firewall configuration, and copy and know-how protection at the controller level. Totally Integrated Automation helps protect the system against unauthorized access and manipulation.

Safety Integrated

Protection of personnel and machinery – within the scope of an integrated overall system

The following applies for tunnels: Complete safety must be guaranteed for people and technology. The solution: The Safety Integrated concept on the basis of Totally Integrated Automation. Whether for simple safety functions or highly complex tasks – the program offers maximum safety. Safety Integrated is a unique, comprehensive, and integrated safety program that covers all tasks in the area of safety engineering – from acquisition, evaluation, and response of the switching systems, through control, all the way to drives.

The comprehensive range of products and systems for tunnels

1 SIMATIC controller

The comprehensive SIMATIC controller portfolio offers the right controller for every application – modular and scalable.

2 SIMATIC H systems

SIMATIC S7-400H reduces the probability of a failure of the automation system and thus contributes significantly to increased availability.

3 SIMATIC ET 200

SIMATIC ET 200 is a multifunctional, modular and discretely scalable system for distributed automation.

4 SCALANCE X

SCALANCE X Industrial Ethernet Switches offer different interfaces, either optical or electrical, and support a host of IT standards.

5 PROFINET und PROFIBUS

Field-proven and standardized fieldbus systems help to significantly reduce investment costs, operating costs, and maintenance costs.

6 SIPLUS RIC

SIPLUS RIC is a telecontrol system based on the SIMATIC S7 automation system with internationally standardized communication protocols.

7 SIRIUS

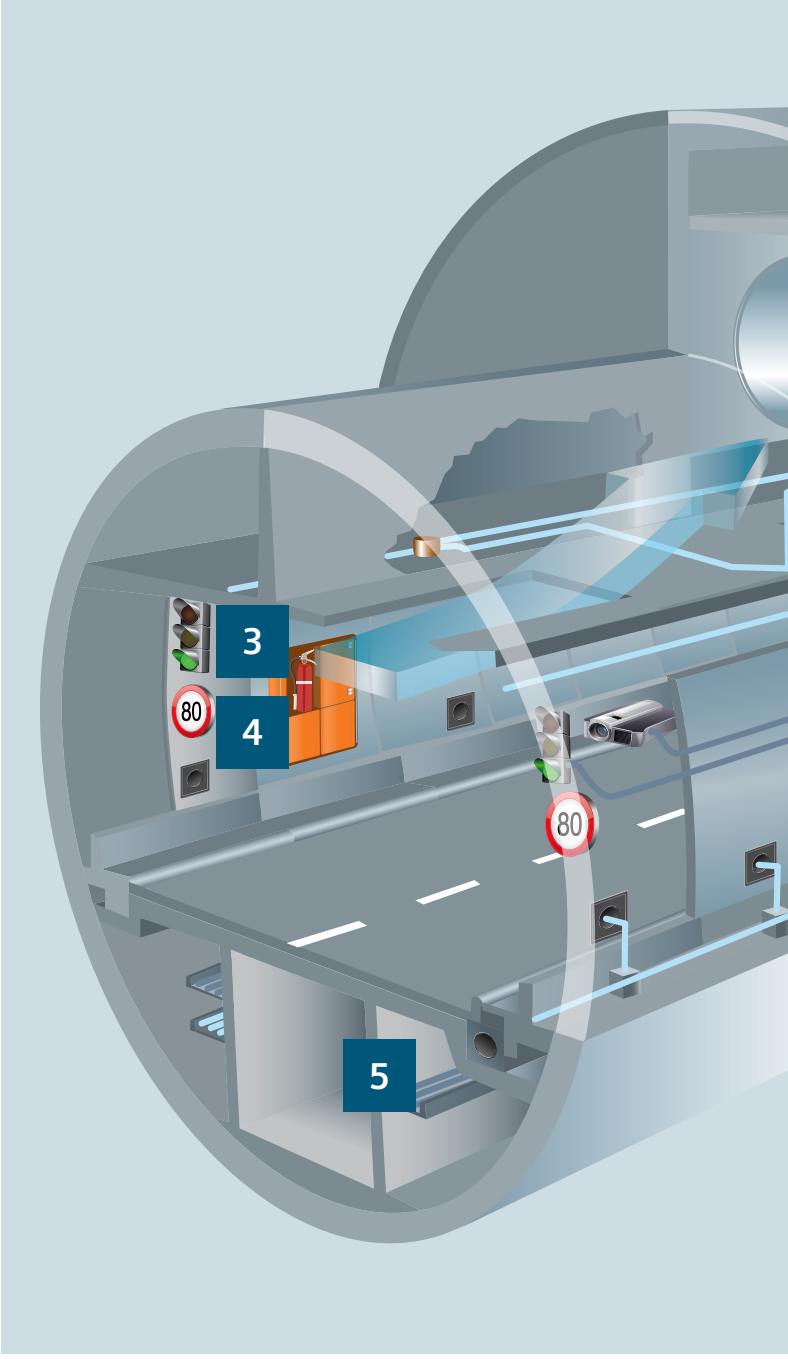
SIRIUS is a comprehensive program for industrial controls in the most diverse industries and areas.

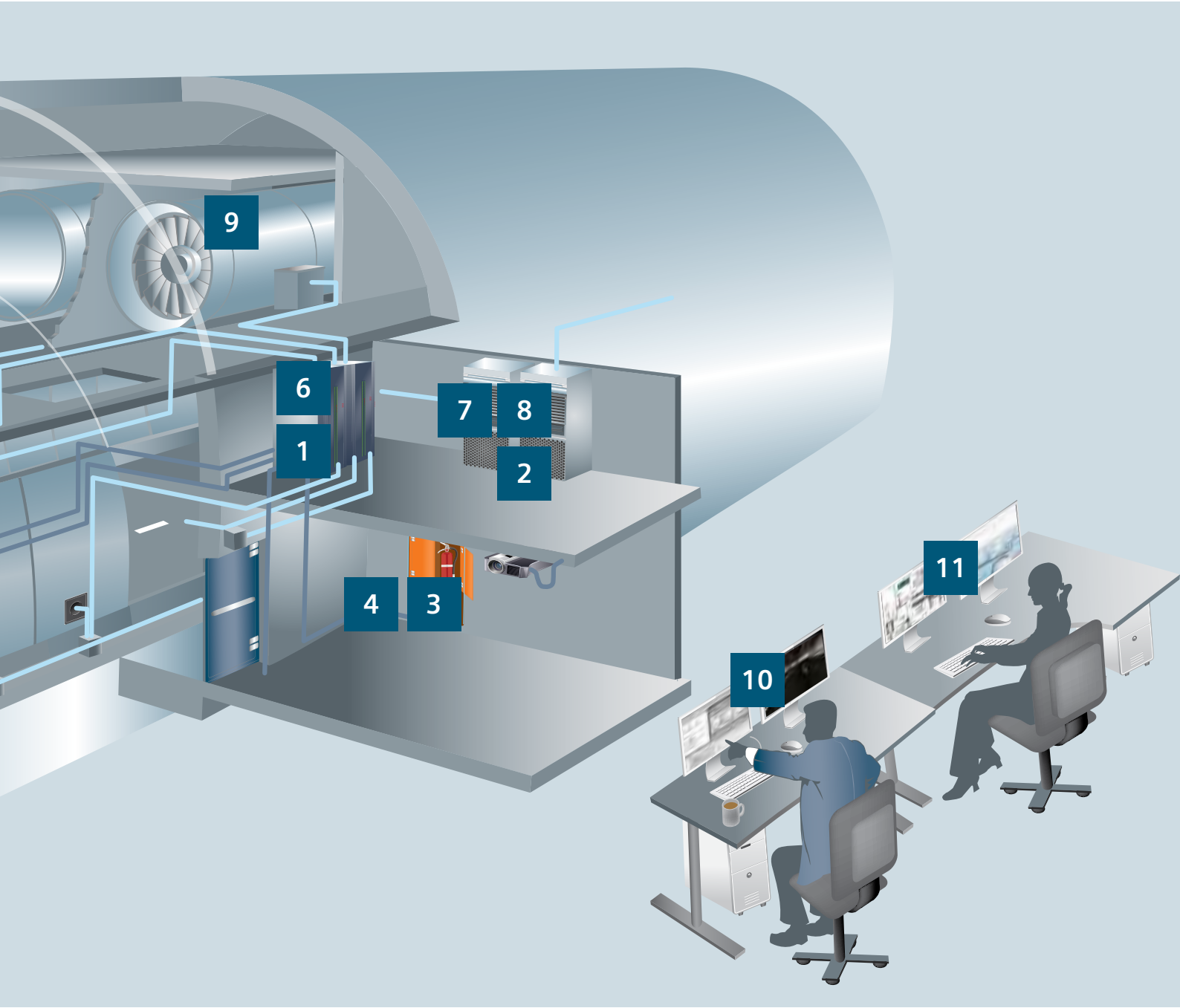
8 SENTRON

SENTRON measuring devices acquire electrical measured values, for example energy values, accurately, reproducibly and reliably.

9 SINAMICS

As part of the modular and scalable drive family, SINAMICS converters offer optimized solutions for tunnels.





10 SIMATIC WinCC / WinCC OA

SIMATIC WinCC / WinCC Open Architecture addresses applications with high requirements for customer-specific adaptations, as well as projects with special system requirements and functions.

11 SIMATIC HMI

Human Machine Interface (SIMATIC HMI) products offer optimal solutions covering all aspects of operator control and monitoring. The right HMI device for every demand.

Control

www.siemens.de/controller

SIMATIC controller

Optimization for the automation of machines and plants in the manufacturing industry

- Extensive selection of CPUs and modules, optimized for just about any application
- Compact and modular design, fail-safe modules with extensive, integrated technology functions
- System diagnostics facilitate fault localization without programming overhead
- Project-wide engineering to enable the implementation of highly integrated systems
- Integrated functions (e.g. PID, motion control) save on costly special solutions
- Fail-safe SIMATIC S7-300/400 CPUs and signal modules enable the integration of safety engineering into the standard automation solution

Benefits in the tunnel

- The scalable design enables an integrated solution, from the automation of an avalanche shed to the control of complex ventilation systems with high availability automation components
- When faced with increasing safety requirements, the controllers can also be expanded with new fail-safe software blocks and thus offer optimal investment protection

Control

www.siemens.de/S7-400H

SIMATIC S7 400H

The powerful controller for system solutions in manufacturing and process applications

- Simple configuring
  - Programming as for a standard system (all S7 programming languages can be used)
- Scalable redundancy and scalable performance
  - Adaptation to the required level of availability thanks to flexible architecture
  - Wide range of high availability controllers with graded range of CPUs, including safety
  - Design with divided rack or with two separate racks
- Event-driven synchronization
  - Bumpless changeover

Benefits in the tunnel

- System redundancy, from the portal to the emergency telephone recess
- Configuration of the controllers in the separate portals enables an increased fault tolerance of the components

Distributed I/O SIMATIC ET 200

The SIMATIC ET 200 family makes distributed automation possible. The components of the system family are available in a host of different sizes and versions

- Modular I/O systems with low to high channel density
- For installation in the control cabinet in degree of protection IP20, or direct in the process without a control cabinet in degree of protection IP65/67
- SIMATIC ET 200SP is characterized by maximum scalability and compact dimensions
- SIMATIC ET 200MP has low parts variance and a modular station design
- Maximum system performance on the basis of PROFINET
- Safety and standard in one system

Benefits in the tunnel

- Thanks to the distributed configuration, the signals can be acquired direct in the subdistribution boards in the tunnel, saving long cable runs
- The distributed I/O system increases the availability of the overall system by means of redundant connection of the modules and the bus system

www.siemens.de/simatic-et200

Distributed I/O

SCALANCE X Industrial Ethernet Switches

In a class of its own in every category

- Flexibility thanks to
  - a comprehensive portfolio with different designs and functional scopes
  - use not only in (harsh) industrial environments, but also in other areas
  - the implementation of different topologies
  - a helpful selection of suitable interfaces (optical / electrical)
- You can find the right switch for every application!
- Fail-safe networks thanks to high-speed redundancy and redundant power supply
- Fast commissioning thanks to simple FastConnect cabling
- Configuration and diagnostics in STEP 7 / TIA Portal

Benefits in the tunnel

- The SIMATIC switch components can be integrated into the overall configuration and thus enable system-wide configuring and diagnostics
- The product portfolio encompasses industry-standard components for the tunnel area and industrial switches with office functionalities for central control rooms

www.siemens.de/scalance

Communication

Communication

www.siemens.de/profibus

www.siemens.de/profinet

PROFIBUS and PROFINET

PROFIBUS – the optimal solution for industry

- Standard and safety-related communication over one bus system
- Fail-safe communication takes place over the PROFIsafe profile
- Increased system availability thanks to redundant design
- PROFIBUS PA is used for connecting process field devices (communication and supply voltage on the same cable)

PROFINET – the open, vendor-independent Industrial Ethernet standard for automation – specified in the world's largest fieldbus organization, PROFIBUS & PROFINET International (PI)

- PROFINET is 100% Ethernet
- Fast and secure data exchange
- Flexibility through configuring different network topologies
- With PROFINET, you can also use the profiles PROFIsafe, PROFIdrive, PROFIenergy and standard communication via TCP/IP – everything over one cable!
- Maximum speed and precision in data transmission – even with high volumes

Benefits in the tunnel

- Redundant and extremely rugged structures can be established with PROFIBUS – the leading bus system in the automation environment
- PROFINET – the future-oriented network topology for I/O interfaces – opens up new possibilities for the bus architecture in tunnels

Communication

www.siemens.de/siplus

SIPLUS RIC

Future-proof and low-cost telecontrol system based on SIMATIC S7 with internationally standardized communication protocols

- Serial transmission IEC 60870-5-101
- Connection of protective devices IEC 60870-5-103
- Ethernet (TCP/IP) IEC 60870-5-104
- Refined versions (SIPLUS extreme) available:
  - Extended temperature range from -25 °C to +70 °C
  - Protection against condensation and unusual medial load (conformal coating)
- Data security:
  - Time stamp at the data source
  - Time synchronization possible using the NTP or IEC protocol
  - Data buffer for bridging communication interruptions – dependent on the CPU – available in up to 16 priority buffers with up to 1500 frames each

Benefits in the tunnel

- SIPLUS RIC opens up new possibilities in the cross-vendor connection of control rooms and automation components thanks to a standardized telecontrol protocol
- The communication blocks merge seamlessly into the configuration and enable low-cost implementation of the telecontrol protocol in the controller

SIRIUS

The comprehensive portfolio covering all aspects of industrial controls for the functional areas switching, starting, protecting, and monitoring

- Achieve the perfect control cabinet easily and quickly thanks to Planning Efficiency™
  - Product information and product data in every process phase
  - Online functions available round the clock and free of charge
  - Savings in configuring costs of up to 80% thanks to complete data provision
  - Savings in installation costs of up to 48% through the use of function modules
- Downtimes reduced by more than 35% thanks to fast diagnostics with IO-Link

Benefits in the tunnel

- SIRIUS offers a host of planning tools for rapid and efficient configuring. In systems with especially long service lives, such as tunnels, the switchgear is characterized by long spare parts availability and customer-friendly replacement strategies for new device generations

www.siemens.de/sirius

Low-voltage controls and distribution

SENTRON protection, switching, measuring and monitoring devices

Comprehensive portfolio for safe, low-cost and flexible use in low-voltage power distribution

- Safe power distribution thanks to protection, switching, measuring and monitoring devices from a single source that are matched to one another
- Communication-enabled products and systems for integration into higher-level management systems
- High flexibility in planning and operation thanks to modularity of the components
- Global use of a host of SENTRON components thanks to international certifications and approvals

Benefits in the tunnel

- SENTRON measuring devices offer clear monitoring of measured values – ideal for the large number of outgoing feeders and loads in tunnel systems
- The components can be easily integrated into the WinCC control system via commonly used bus systems

www.siemens.de/sentron

Low-voltage power distribution

Drive technology

www.siemens.de/sinamics

SINAMICS

The integrated drives family for every application

- The complete and integrated drives family that covers all performance levels. The converters are characterized by maximum flexibility, functionality, and engineering efficiency
- Wide performance range from 0.12 kW to 85 MW
- Maximum efficiency in conjunction with the SIMATIC, SIMOTION and SINUMERIK control systems
- Optimally integrated into the automation system with PROFIdrive, PROFIsafe and PROFIenergy
- Powerful, drive-autonomous safety functions. Shared engineering with just two tools for all drives: SIZER for configuring and Startdrive for parameterizing and commissioning

Benefits in the tunnel

- System-wide integration of the SINAMICS converters into the overall SIMATIC system enables optimal integration and diagnostics of the ventilation system

Visualization

www.siemens.de/
wincc-open-architecture

SIMATIC WinCC Open Architecture

SIMATIC WinCC Open Architecture – scalable, flexible and open SCADA standard software

- Object orientation
  - Efficient engineering and flexible system expansion
- Scalability & flexibility
  - From 500 I/Os to 10 million I/Os
  - From a single-user system to 2048 networked systems
  - Platform-neutral for Windows, Linux, and Solaris
- Maximum availability and safety requirements
  - Hot standby redundancy
  - SIL 3 certification in accordance with IEC 61508
  - Data security through KERBEROS
- Openness
  - Comprehensive connection options: SIMATIC S7, OPC, Modbus TCP/IP, IEC60870-5-101/104, DNP3

Benefits in the tunnel

- Hot standby redundancy can be seamlessly integrated into the redundancy concept of tunnel systems
- The scalable design enables integration of a large number of data points of frequently lengthy tunnel systems - of special benefit to centralized control rooms

SIMATIC WinCC (SCADA)

SCADA system for global use in all industries

- Plant transparency through Plant Intelligence
- Efficient and user-friendly in engineering and operation
- System-wide scalability from the single-user system to distributed Web-based solutions with access via the Intranet/Internet
- High availability thanks to redundancy and integrated process diagnostics
- Open standards for simple integration

Benefits in the tunnel

- The redundancy function corresponds to all the specifications of a redundancy concept for tunnel systems - from the station in the tunnel to the centralized control room
- The automation components can be optimally integrated into the SCADA system

www.siemens.de/wincc

Visualization

SIMATIC HMI

HMI devices for all requirements, for system-wide configuring, data management, and communication

- High-luminance widescreen displays for optimal readability and expanded display options (up to 40% more visualization area)
- Efficient energy management thanks to displays that can be dimmed by up to 100% with LED backlighting and use of PROFIenergy for coordinated shutdown during breaks
- Designed for harsh industrial environments
- Device versions also as SIPLUS extreme components for extended temperature range and aggressive atmospheres
- Maximum energy efficiency through integration in the Totally Integrated Automation Portal (TIA Portal)

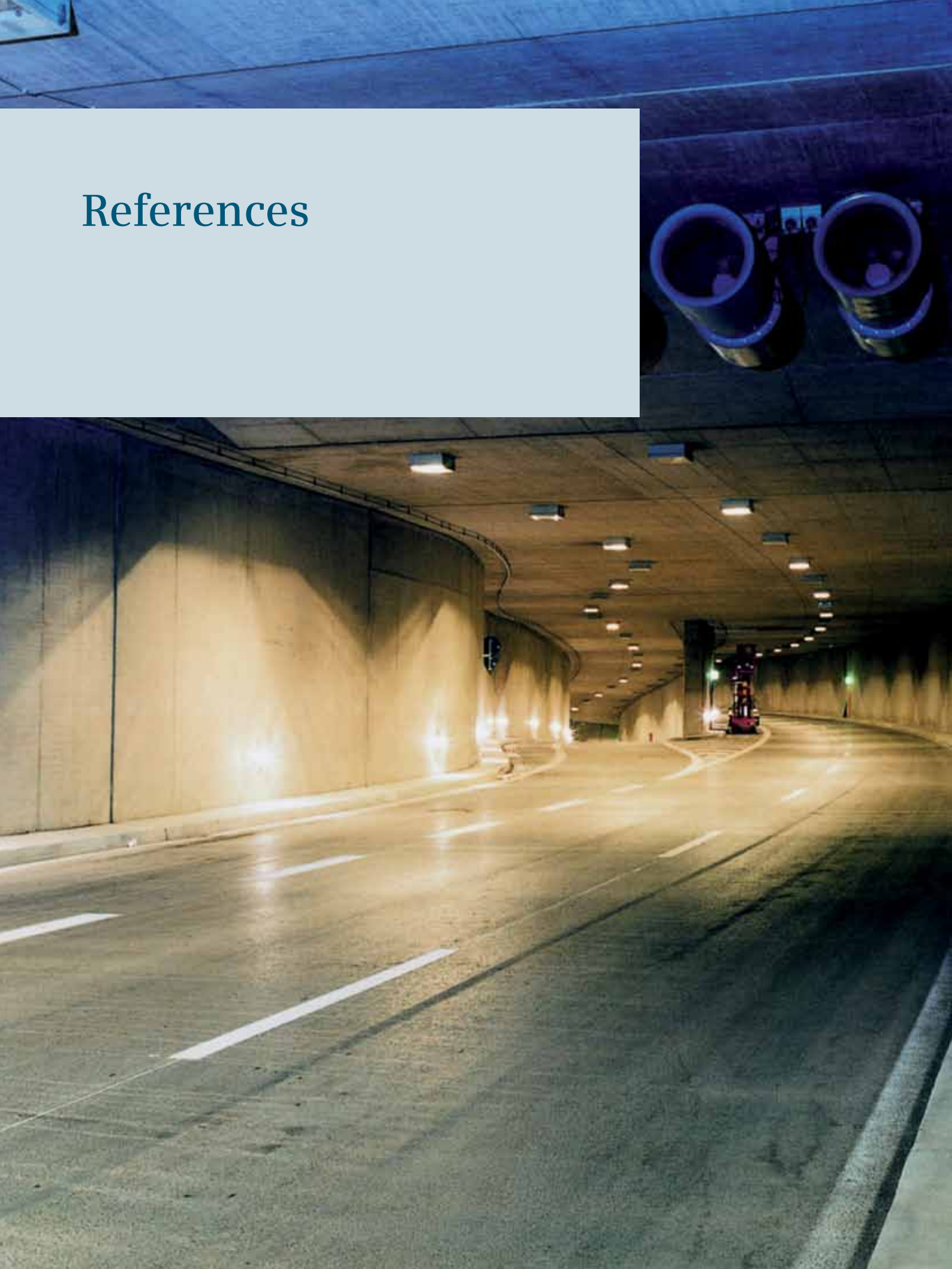
Benefits in the tunnel

- SIMATIC HMI devices offer the option of local operation of ventilators or other system components in the tunnel
- Simple commissioning of individual components direct on-site

www.siemens.de/simatic-hmi

Visualization

References



Tunnel control room integration of Tyrol, Austria

Best practice from Austria

Requirements

The goal of the project was the local and technical integration of the tunnel control room of the Austrian state of Tyrol into the higher-level Tyrol control center to leverage synergy effects while simultaneously increasing levels of safety for road users and emergency services.

Siemens solution

The tunnel systems were visualized via the process control system (PCS), with which they are fully monitored and controlled. Each system component, such as ventilation, lighting, traffic lights, and cameras, can thus be operated individually at the click of a mouse in the tunnel monitoring center.

The PCS is connected to the command and control system of the Tyrol control center via an interface. Emergencies and faults can thus be handled directly via the command and control system.

Customer benefits

Thanks to Totally Integrated Automation, the tunnel operator can carry out block admission in accordance with legal guidelines when traffic is heavy. Thanks to the interface between the process control system and the command and control system, the responsible emergency services in Tyrol can be alerted directly from the command and control system.

Gotthard road tunnel, Switzerland

Best practice from Switzerland

Requirements

The 17-km long Gotthard road tunnel was opened in September 1980. The roadway is lit by the tunnel lighting. Adaptation lighting at the portals guarantees optimal entry to, and exit from, the tunnel. The software and automation work, within the scope of the modernization project, was carried out in 2007 by ticos.

The following partial solutions were requested:

- Control of the tunnel lighting, the adaptation lighting, and the fire emergency lighting
- Entry lighting for the protected areas
- Safety lighting
- Communication with the plant management level
- Web browser via the ATM network

Siemens solution

Siemens supplied two master computers in hot-standby design and seven slave computers with WinCC Open Architecture. The individual controllers are connected together via a V-LAN – communication with the slave and master computers takes place via Ethernet (TCP/IP).

Customer benefits

The redundant master computer systems in the command centers Göschenen and Airolo enable optimal operations management. Even if one of the systems fails completely, unrestricted operation and monitoring of the plant remains guaranteed. Direct access right down to the individual control PC level is possible via the implemented network. Adaptations in the software (Step 7) can be made centrally – no need to go to the controller itself to make the adaptations. This means significant savings in time and costs for the contractor.

Tunnel project A43 motorway, France

Best practice from France

Requirements

Between 2009 and 2011, tunnel modernization was carried out on the A43 motorway. Clemessy supplied the control system for the safety functions of all seven tunnels on this motorway. The project included the dynamic control of the light signal systems dependent on events (accidents or planned construction work), the control of the safety ventilation system using intelligent algorithms dependent on air pollution levels and the natural flow of air (adaptively optimized smoke extraction), as well as the control of the lighting and the video systems.

Siemens solution

Tunnel systems equipped with SIMATIC S5 controllers upgraded to SIMATIC S7 controllers. With the new control system, it is now possible to monitor all systems and to inform the system engineers in real time. This information is also forwarded to a higher-level system.

Customer benefits

Maximum availability of the system. The rugged and field-proven system owes its properties to the redundant SIMATIC S7-400H programmable logic controllers and the connection to a redundant fieldbus.

The operator-friendly and ergonomically designed control system allows the system engineer to distinguish at a glance between technical alarms and operational alarms, and thus to take the correct measures quickly.

The concept of a tunnel control room

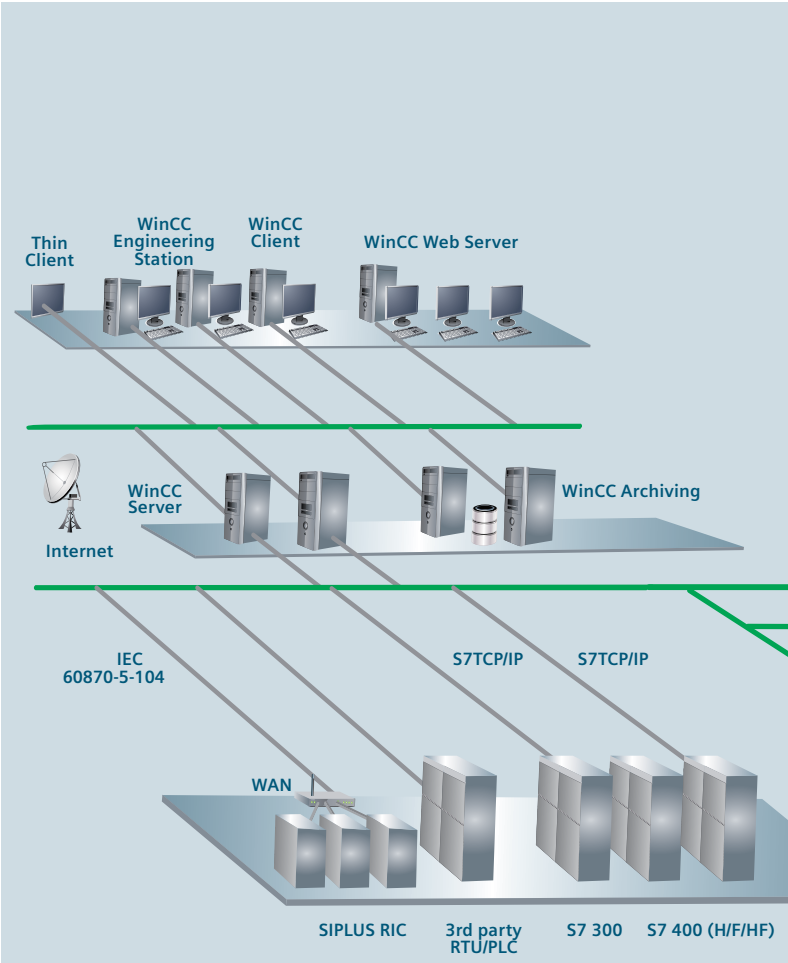
With its automation components, Siemens offers an integrated concept that can be adapted optimally to customer wishes and that never compromises on controller availability.

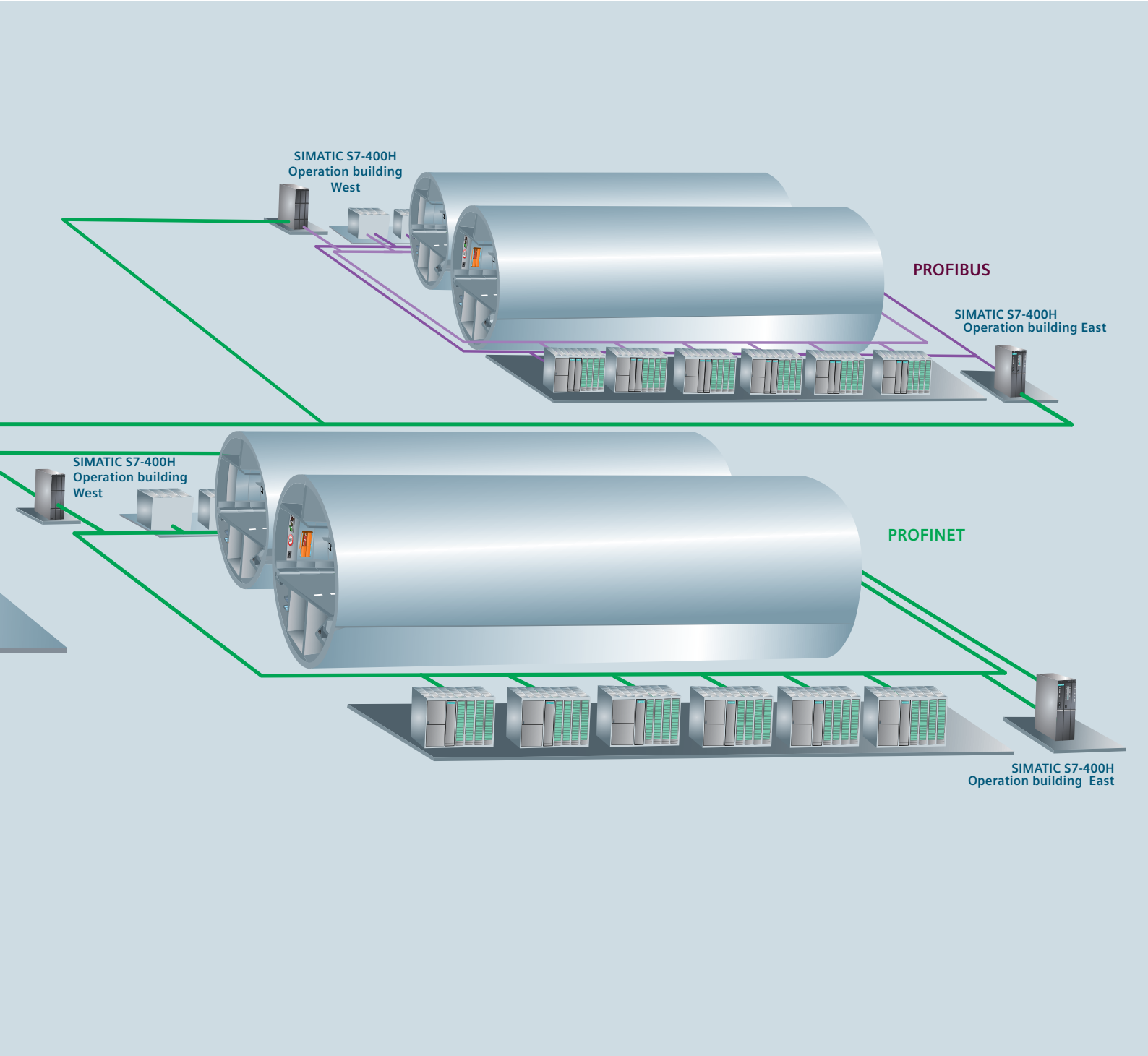
At the control level, you can choose between WinCC or WinCC OA. For the highest requirements, WinCC OA offers SIL3 certification.

WinCC and WinCC OA support the most diverse communication protocols and thus offer maximum flexibility and investment security.

For the automation level of the tunnel itself, you can choose between PROFINET and PROFIBUS. Both fieldbus systems have already proved their worth in the most diverse industries and applications.

With its redundant design and the use of durable PLC modules, the Siemens automation concept offers a high degree of availability and investment security for tunnels of all sizes.




SIMATIC S7-400H
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Operation building East

Additional information

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