



direct industry

Information for Electrical Engineering and Industrial Automation.  
March 2011

# LIGHT FOR SAFETY IN THE TUNNEL Page 18



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**BLUETOOTH® IS NOT EQUAL TO BLU-  
ETOOTH®** Page 06



# EDITORIAL



*Dear reader,*

Spring pressure connection technology – a world standard today! Electrical connection technology is inconceivable without it. Spring pressure connection technology in rail-mounted terminal blocks has mastered its worldwide triumphal procession brilliantly: over the years, it has proven itself in practice and it is now recognized internationally.

The beginnings were difficult, but despite initial skepticism about this vibration-proof, maintenance-free, and quick-connect connection technology, the WAGO concept has prevailed worldwide thanks to its technical advantages.

That which began with a few rail-mounted terminal blocks has now been expanded to include the entire product range in the switch cabinet: power supplies, switches, relays, interface modules, and automation components. Today, spring pressure connection technology can be used as connection technology everywhere in a switch cabinet.

However, the suppliers of connection technology differ in at least two respects:

- Space-saving on the carrier rail: who has the narrowest modules with spring pressure connection technology – and pluggable too?
- Large sizes: who can also offer modules for power supply up to a conductor size of 95 mm<sup>2</sup> with spring pressure connection technology?

Anyone who does not know this already will find the answers in this magazine.

We wish you happy reading and browsing through our WAGOdirect industry.

Best regards,

Jürgen Schäfer

Sales Manager

# SURELY A GOOD FEELING

## Feedback-free modules reduce technical effort

■ Under certain circumstances, the increasing safety requirements increase the technical effort on machines and systems in order to be able to adhere to the required safety category. Systems with feedback-free output modules like the WAGO-I/O-SYSTEM offer the full functionality of an industrial controller without influencing the safety function.

With the feedback-free output modules in the WAGO-I/O-SYSTEM 750, control functions can be integrated into the safety function without actively influencing their safety category. In case of error, the safety switching device switches the feedback-free outputs off and allows a safe operation of up to SIL3 or PLe/Category 4. The functional properties of the safety switching device can be reduced to a minimum with the use of the feedback-free modules and they therefore help to save costs without significantly compromising the automation function.

### ■ How does this look in practice?

The hazard analysis of a finished application specifies a defined safety category (Cat) and requires the following safety measures:

- A safety cell consisting of a safety door, an emergency off button, and two drive motors for conveyor belts as well as a vertical conveyor should be implemented from the control-technical point of view.
- With activation of the emergency off button or if somebody enters the cell, all drives should be switched off on 2 channels and 2 pins.

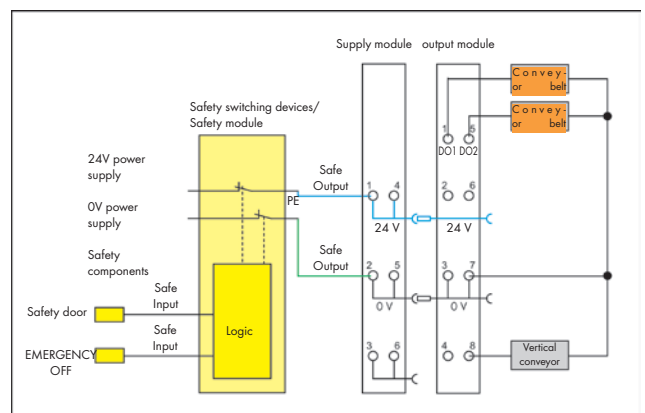
As a technical solution, the WAGO-I/O-SYSTEM 750 with feedback-free output modules and a safety switching device according to the protection category are used for the controller. The feedback-free output modules were selected because in case of a component error, there are no effects on the safety function.

The SPS program in the controller of the WAGO-I/O-SYSTEM controls the three actuators „conveyor belt 1,“ „conveyor belt 2,“ and „vertical conveyor“ according to the machine function. In case of an activation of the emergency off button or an opening of the safety door, the safety switching device switches off the supply voltage of the feedback-free output modules on 2 pins. As a result, all actuators are switched off by switching off the control voltage via an output

pair in the safety switching device. If, for example, several motors must be switched off, they can be combined into a „potential group.“ This saves real money, since the safety switching device can be designed smaller with respect to the number of outputs and there is no need for additional switching mechanisms in the power branches of the actuators.

Text: Jens Eickelmann und Helmut Börjes, WAGO: Jens Eickelmann and Helmut Börjes, WAGO

Photo: WAGO



2-channel and 2-pin switching off of the supply voltage

- Large selection of feedback-free I/O modules
- No effect on the safety function
- Safe operation up to SIL3 or PLe/Category 4

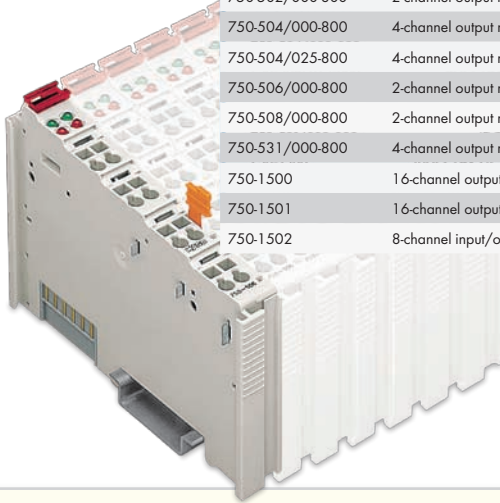






The following modules are available feedback-free:

750-501/000-800	2-channel output module	2DO 24 VDC; 0.5 A/R
750-502/000-800	2-channel output module	2DO 24 VDC; 2.0 A/R
750-504/000-800	4-channel output module	4DO 24 VDC; 0.5 A/R
750-504/025-800	4-channel output module	4DO 24 VDC; 0.5 A/-20...+60°C/R
750-506/000-800	2-channel output module with diagnostic function	2DO 24V DC, 0.5A/diagnostic/R
750-508/000-800	2-channel output module with diagnostic function	2DO 24V DC, 2.0A/diagnostic/R
750-531/000-800	4-channel output module	4DO 24 VDC; 0.5 A/2 conductor/R
750-1500	16-channel output module with ribbon cable plug, positive and negative-switching	16DO 24 VDC; 0.5 A/ribbon cable plug/R
750-1501	16-channel output module with ribbon cable plug	16DO 24 VDC; 0.5 A/ribbon cable plug/LSS/R
750-1502	8-channel input/output module	8DI/8DO 24 VDC; 0.5 A/ribbon cable plug/R



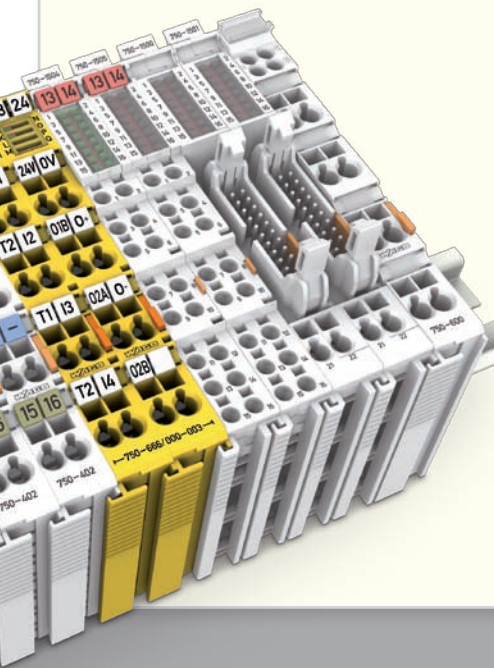
The feedback-free bus modules of the WAGO-I/O-SYSTEM simplify the safety design of systems.

## New PROFI-safe Module with iPar Functionality

■ A high-performance, fail-safe 4-channel digital input and 1-channel digital output module (75x-666) joins WAGO's PROFI-safe I/O modules with iPar functionality.

This safety module supports both V1 (PROFI-BUS) and V2 (PROFIBUS, PROFINET) PROFI-safe protocols. It has a configurable, fail-safe output featuring two semiconductor switches (24V/10A) and four clock-sensitive inputs. The inputs can be connected to potential-free, emergency-off switches with contacts, safety door switches, mode selectors, as well as safety sensors and semiconductor outputs (e.g., light barriers, PLC outputs). Sensors are directly connected via 24V or differently clocked outputs (e.g., T1, T2) to the module's inputs (e.g., I1, I2). The power outputs switch DC-13 inductive loads with up to a 2A-rated current without requiring any additional external circuit. Using an additional, external free-wheel circuit or resistive loads, the module delivers up to 10A for power outputs connected in series, or even up to 2x10A when connected in parallel. The power outputs operate in both bipolar (high-side/low-side switching) and unipolar (common potential on one side of the load) modes.

For both inputs and outputs, the safety module monitors short-circuits, cross circuits and 24V voltage supply from separate sources. Safety-relevant parameters (e.g., operating modes, switching off test pulses, discrepancy or filter times) can be easily configured via WAGO-I/O-CHECK. This configuration tool can be conveniently integrated into engineering systems supporting the Tool Calling Interface (TCI). When exchanging modules, parameters are automatically downloaded into the control unit via PROFI-safe-compatible iPar server – depending on settings. The PROFI-safe address can be set via DIP switch or WAGO-I/O-CHECK.



# BLUETOOTH® IS NOT EQUAL TO

## A differentiation must be made for industrial applications.

■ Many people use *Bluetooth*® technology at home and in the office as easily as they use their GSM mobile phone. However, in the automation environment, there are certain stubborn preconceptions against the industrial use of this technology. This article reveals to what extent industrial solutions must be distinguished from the mass market and where preconceptions are not justified.

A typical preconception is that *Bluetooth*® interferes with other technologies since the ISM frequency band between 2402 and 2483 GHz is always completely occupied. This is partially true for mass market devices. The mechanisms of „adaptive frequency hopping“ and the adaptive transmission power that belong to the *Bluetooth*® standard attempt to automatically detect and avoid interference with other radio networks. Thus, a great degree of coexistence is guaran-

teed from the factory onwards. Since both mechanisms only monitor the quality of their own data transmission, however, they are no guarantee of the fault-free operation of other radio connections. Therefore, with channel blacklisting, industrial implementations allow the explicit blocking of parts of the *Bluetooth*® frequency band for data transmission. Therefore, in ongoing operation, a disturbing influence on other radio networks on these frequencies is ruled out. In addition to the data transmission, the establishment of the connection must also be regarded. With *Bluetooth*® as with other radio technologies, during the search for other devices and when establishing the connection, important coexistence mechanisms are disabled, which means that for a time, there is a greater disturbance potential. Here, special mechanisms in industrial implementations improve the behavior while the connection is being established. They are called „BlueECo mode“ and „low emission mode™,“ and by limiting the transmission power or the duration of search procedures, they reduce the disturbance potential to a minimum.

■ The typical range is not the maximum possible

The usually-small range of typical *Bluetooth*® connections in a domestic environment is not due to the technology itself, but rather to the consequences of device optimization: compact dimensions, long rechargeable battery run time, and especially low manufacturing costs. In order to comply with standards, the transmission power and receive sensitivity must satisfy only comparatively low requirements. Therefore, some devices in the *Bluetooth*® class 3 only achieve a link budget of 40-50 dB, which limits the range to 1-3 m. Industrial implementations of the *Bluetooth*® class 1, by contrast, can demonstrate a link budget of 100-110 dB, which in the free field allows ranges of 1 to 3 km and in buildings, overcomes several walls or other obstacles easily.

■ Password and encryption offer the necessary security

When the *Bluetooth*® technology established itself years ago as the standard interface for portable devices, the allegedly-lacking security became a topic of discussions from time to time due to „Bluejacking“ (undesired third-party usage of the connection established). At that time, a care-free handling or the non-use of the security mechanisms offered by the *Bluetooth*® standard was the reason for a successful attack. After this problem was recognized, there was rapid silence surrounding this topic. The existence of a secure *Bluetooth*® connection can only be determined with high-quality measurement equipment. Therefore, industrial implementations use the existing security mechanisms, including „security mode 3“ and the „non-discoverable mode“ and permit the selection of a secure PIN for authentication and encryption.

■ *Bluetooth*®: a suitable transmission type for automation

In direct comparison with wired data transmission, wireless



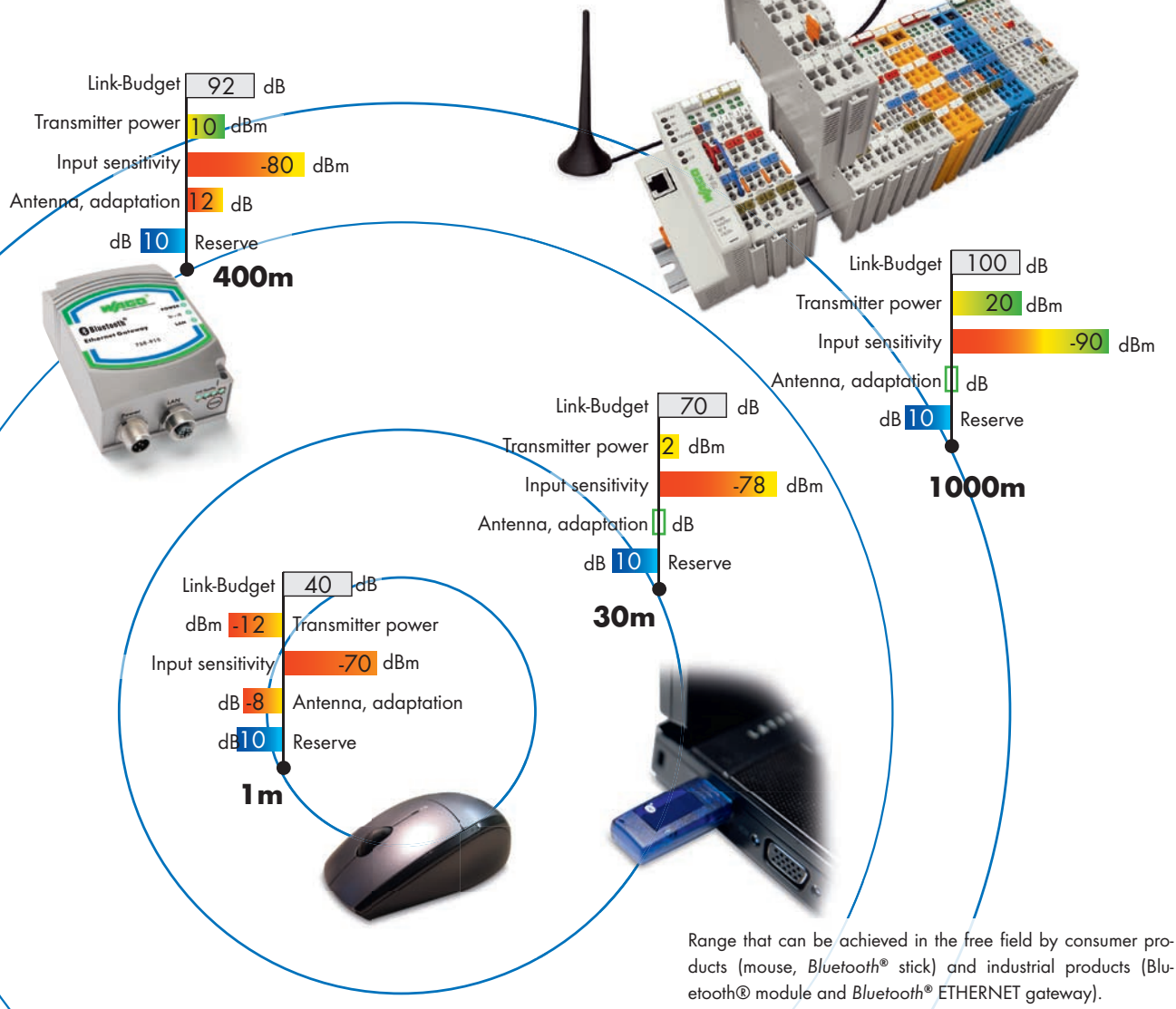
# BLUETOOTH®

- Good co-existence with other radio technologies
- Long range
- Transmission power penetrates walls and obstacles

technologies exhibit poorer time behavior - and a lower data rate. However, for many automation tasks, the data rates and cycle times run below what the radio connection can physically bear. Therefore, industrial fieldbuses such as PROFINET and PROFIsafe can be expanded wirelessly without a problem. For example, the incorporation of a PROFINET participant in a segment with Bluetooth® is easy to implement in real time if a bus cycle time of 16 ms is selected for the process data. With a problemless in real time Bluetooth® connection, the special industrial implementations ensure good coexistence with other radio connections. Thus, a Bluetooth® radio link is robust enough and does not have to shy away from comparison with a wired solution. For mechanically, it is even superior: a wired connection can be injured mechanically (by wear, a backhoe shovel, etc.), and a disturbance is usually followed by service costs. The wireless connection, by contrast, can only be disturbed by competing radio transmissions. And even if these have not been excluded by

professional frequency planning, they would only cause temporary interference that neither lasts a long time nor results in service costs. Mechanical damage (wear, excavator bucket etc.), and a disturbance has mostly maintenance costs as a result. The wireless connection can instead only be disturbed by competing radio transmissions. And even if these are excluded by professional frequency planning, they would only lead to temporary impairments, which are neither permanent nor require maintenance work.

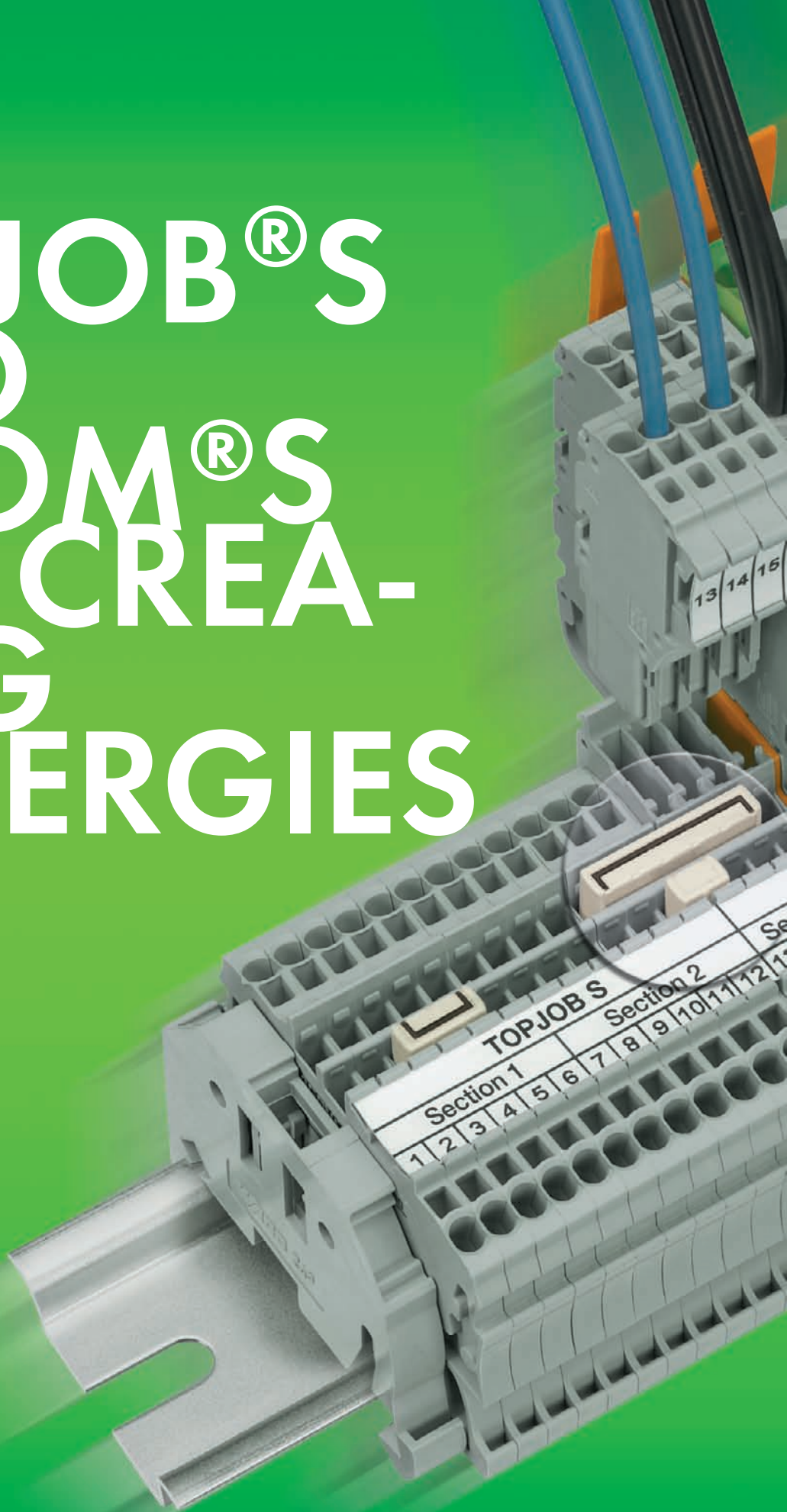
Text: Alexander Blumenröther, WAGO  
Photo: WAGO



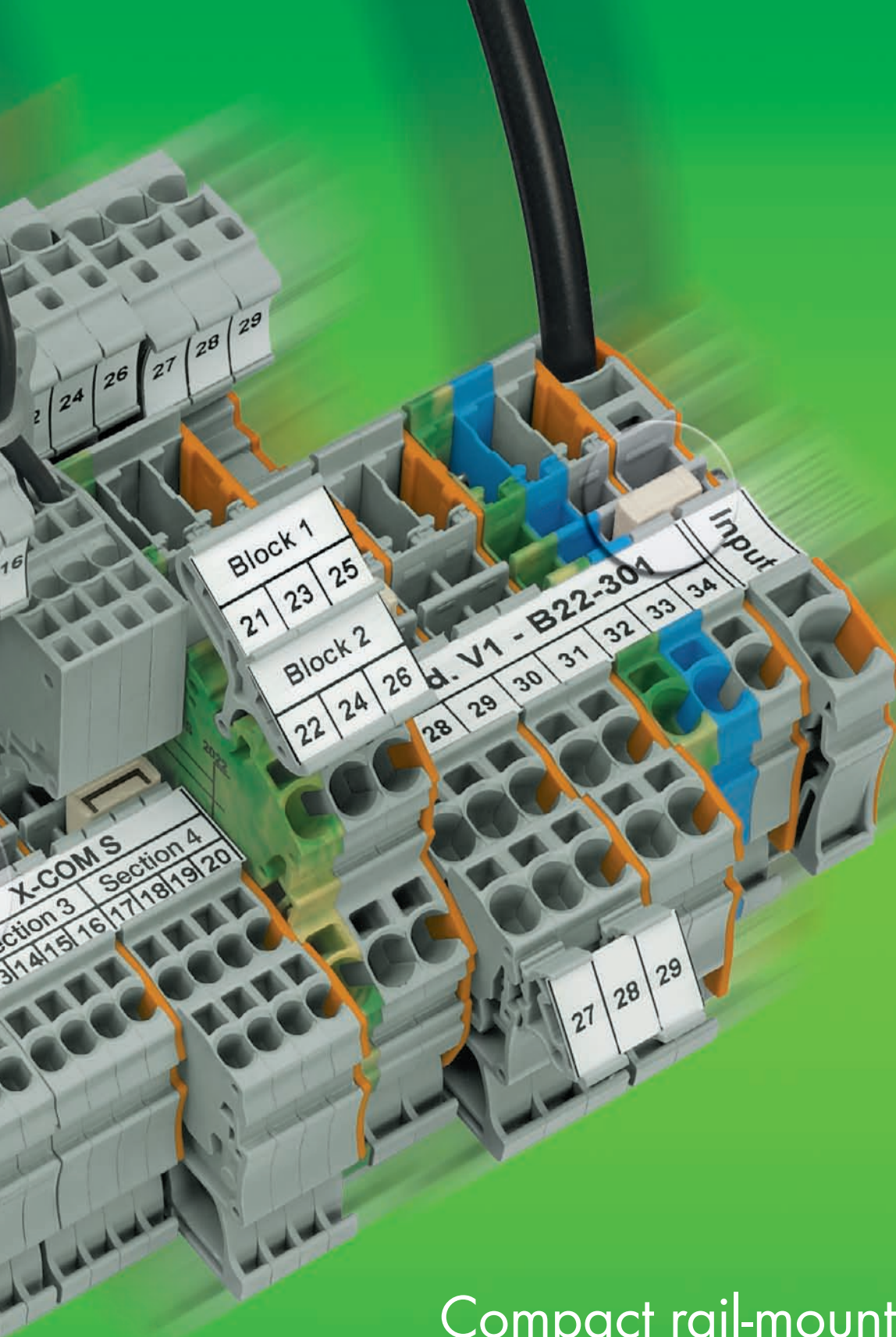
Range that can be achieved in the free field by consumer products (mouse, Bluetooth® stick) and industrial products (Bluetooth® module and Bluetooth® ETHERNET gateway).



# TOPJOB<sup>®</sup>S AND X-COM<sup>®</sup>S ARE CREA- TING SYNERGIES







Compact rail-mounted terminal  
blocks  
for machines and systems

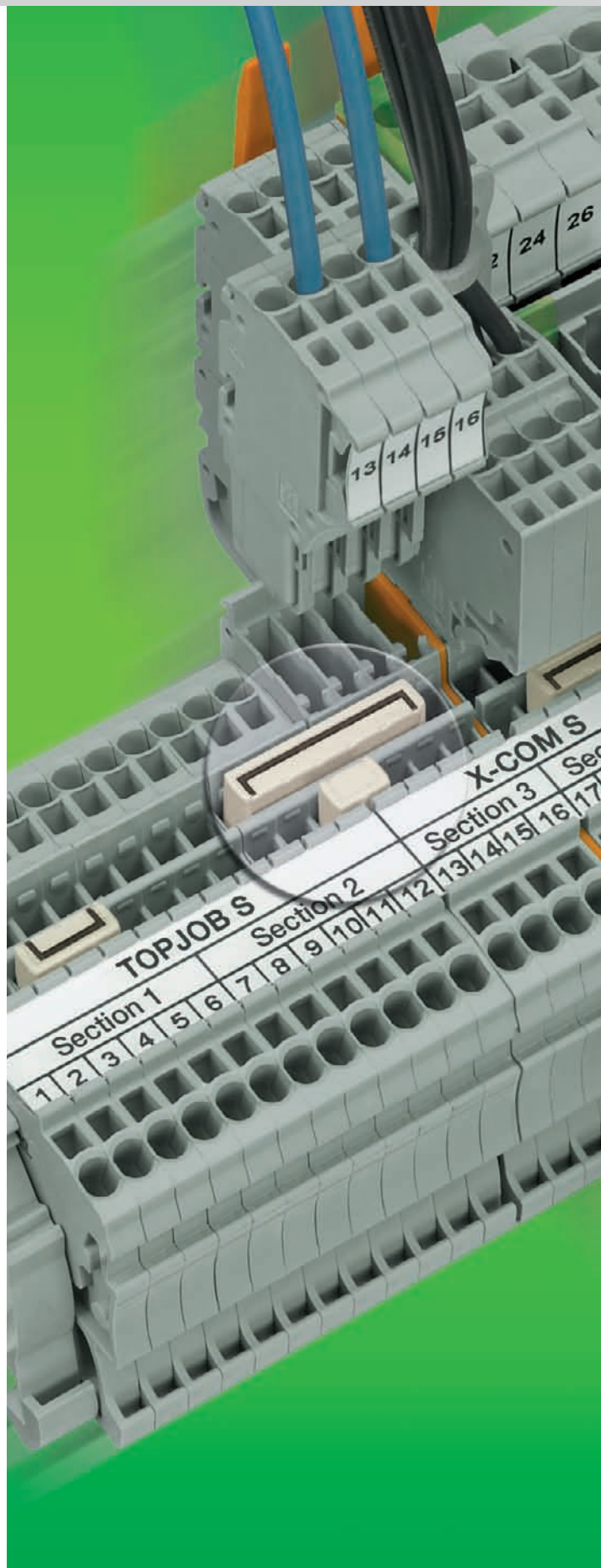
# TOPJOB®S AND X-COM®S

■ In order to connect machines and systems to the power supply, compact and flexible rail-mounted terminal block systems are in demand today. Important selection criteria are the space requirements, transitions to other module families, and an easy labeling system. Thanks to the CAGE CLAMP®S connection used, the rail-mounted terminal blocks in the WAGO TOPJOB®S product line are especially small and they accommodate a wide range of conductor sizes. Furthermore, modules in the XCOM®S family with the same contours create an elegant transition to pluggable modules that can be labeled continuously.

Today, machines and systems must correspond ever more exactly to customer desires. This demands that machine and system builders create sophisticated applications that leave the customer room for play for customer-specific solutions and changes. Accordingly, ever higher demands are being made of electrical connection technology. These are: secure connection technology, easy handling, small dimensions, quick labeling, and flexibility with respect to the connection type. For on the one hand, the functionality of an application increases, which means that more clamping units are needed; on the other hand, easy handling on through to the possibility of pre-assembly is required.

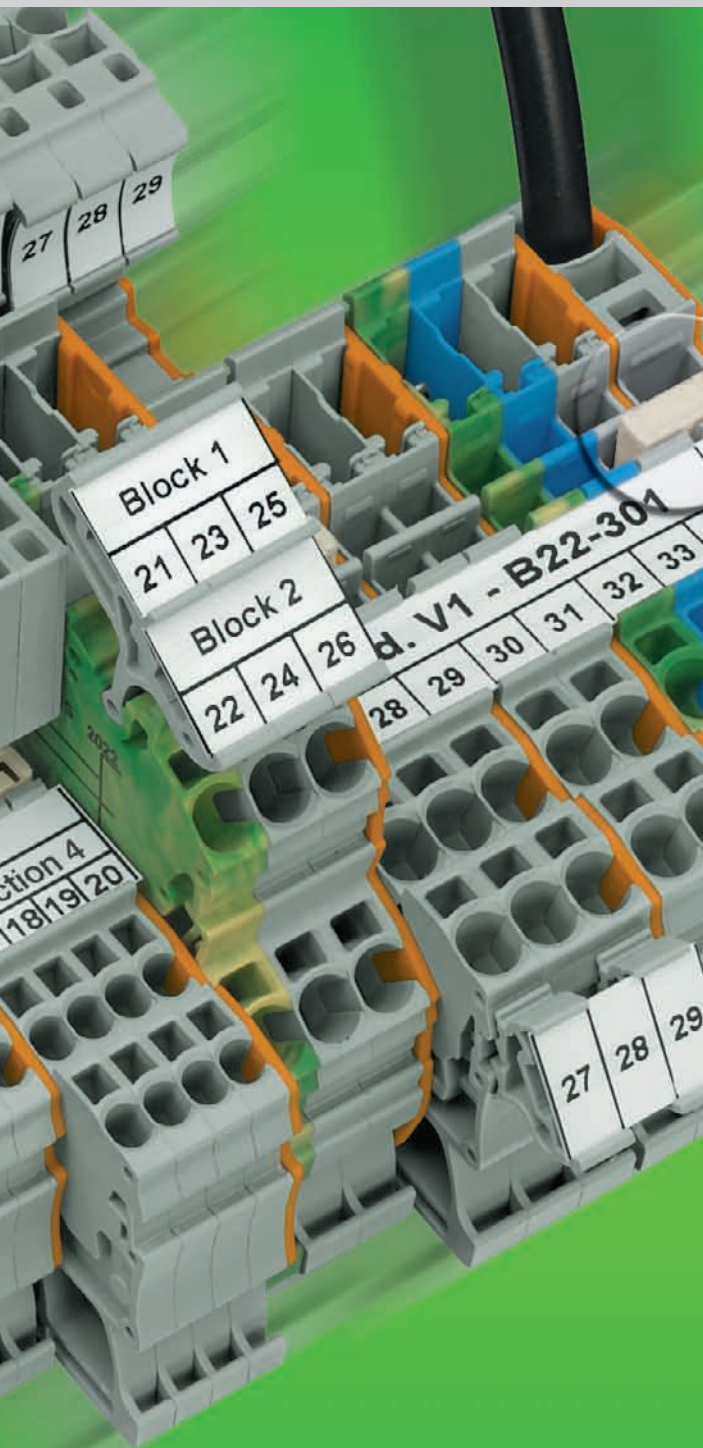
The rail-mounted terminal blocks in WAGO's TOPJOB®S product line are very small due to the compact CAGE CLAMP®S spring clamp connection used. In addition, single-wire and fine-stranded conductors with pre-treated wires can be contacted easily thanks to direct plugging. Fine-stranded conductors without wire pre-treatment and those with small sizes can, as is customary in other product lines, be connected by opening the clamping unit in advance with the help of a screwdriver. For all modules, the conductor entry opening is slanted by at least 15°. This gives the user a bit more space to grasp the conductor. The whole product line accommodates conductor sizes from 0.14 to 25 mm², for module widths from 3.5 to 12 mm. For the module widths 3.5 and 5.2 mm, the X-COM®S line of rail-mounted terminal blocks provides modules with the same contours. They allow a continuous labeling and thanks to the pluggable wiring side, they support the pre-assembly of system parts.

■ A rail-mounted terminal block system for all applications  
Thanks to the large selection of modules, TOPJOB®S suitable for both applications in switchgear manufacture as well as in electrical installation. It offers 2 and 3-wire through terminal blocks with nominal sizes from 1 to 16 mm² as well as 4-wire modules with 1; 2.5, and 4 mmsowie 4-Leiter-Klemmen mit 1; 2,5 und 4 mm² nominal size. In the 2.5 mm² size range there are modules with a conductor entry opening slanted by 35°, which allows tight laying radii and





# ARE CREATING SYNERGIES



- Modules in 3.5 mm grid save still more space
- TOPJOB®S and X-COM®S are coordinated with one another with respect to their construction
- Both systems have all advantages of a modular program: continuous labeling and commoning

thus shorter paths to the cable duct. If a higher connection density per module is desired, double and triple-layer modules are the first choice. For each series, there are ground conductor terminal blocks, which contact automatically when they are snapped onto the rail. In addition to pure through-switching, many applications require additional functions. Thus, for example, there are 2 and 4-wire disconnect and measurement modules for use in control systems, as well as double-decker disconnect terminal blocks. Additional variants are double-decker diode modules for lamp testing and collective fault switching as well as a LED module for monitoring control and operating current circuits. If modules of a system controller or devices should be pre-wired, the rail-mounted terminal block program also offers plug connectors that are contacted in the commoning ducts of the standard modules, wodurch enge Verlegeradien und damit kürzere Wege zum Kabelkanal erzielt werden können. Wird eine höhere Anschlussdichte pro Klemme gewünscht, sind Doppelstock- und Dreistockklemmen die erste Wahl. Für jede Serie gibt es Schutzleiterklemmen, die beim Aufrasten auf die Tragschiene automatisch kontaktieren. Viele Anwendungen erfordern neben der reinen Durchgangsschaltung zusätzliche Funktionen. So gibt es beispielsweise für den Einsatz in Steuerungsanlagen 2-Leiter- und 4-Leiter-Trenn- und Messklemmen sowie Trennklemmen in Doppelstockbauweise. Weitere Varianten sind Doppelstock-Diodenklemmen zur Lampenprüfung oder Sammelstörmeldesaltung sowie eine LED-Klemme zur Überwachung von Steuer- und Arbeitsstromkreisen. Sollen Module einer Anlagensteuerung oder Geräte vorverdrahtet werden, bietet das Reihenklemmenprogramm auch Steckverbinder, die in den Brückerschächten der Standardklemmen kontaktiert werden.

## ■ TOPJOB®S, 2000 series: narrow and strong

For conductor sizes from 0.14 to 1.5 mm<sup>2</sup>, WAGO developed the 2000 series, with a module width of just 3.5 mm. With its dimensions, it is among the narrowest rail-mounted terminal blocks on the market. Despite its compact size, the modules can be used with a voltage of 800 V according to IEC or 600 V according to UL. In addition to 2-wire, 3-wire, and 4-wire through terminal blocks for nominal sizes up to 1 mm<sup>2</sup>, the series also offers double-decker modules for various potential configurations (L, N/L, PE/L, etc.). These modules have a high contact point density: per through connection, theoretically only half the module width (1.75 mm) is placed on the carrier rail. The latest module in the 2000 series is the double-through module. It conducts two potentials instead of just one potential in just one story. The connections to a potential are on the same module side.

## ■ Pluggable pendant – narrow without rival

To fit the TOPJOB®S rail-mounted terminal blocks in the 2000 and 2002 series, WAGO developed the X-COM®S plug connector system with the 2020 and 2022 series. The 2020 series, also called the

X-COM<sup>®</sup>S MINI, is the narrowest pluggable rail-mounted terminal block on the market. Like the TOPJOB<sup>®</sup>S 2000 series, it is just 3.5 mm wide, however with the same contours as the X-COM<sup>®</sup>S system in the 5.2 mm grid and the through modules of the TOPJOB<sup>®</sup>S series. Thanks to the same jumper and labeling positions, the modules can be combined with one another. Furthermore, pre-assembled system parts can be integrated easily in the smallest space. The 2020 and 2022 series include 1-wire and 2-wire plug connectors with up to 15 pins, as well as 1-wire 1-pin and 2-wire 2-pin modules. PE versions that contact automatically with the carrier rail are also available. The modules are approved for up to 500 V with 13.5 A.

#### ■ Multi-faceted jumper and potential tapping

Both rail-mounted terminal block series have an integrated, spring-loaded jumper system that allows the use of comb-style jumper bars, test plugs and connectors. The jumper can, despite its small dimensions, be loaded up to the rated current. Thanks to the spring loading in the module, the comb-style jumper bars are not specified for a nominal sizes; instead, they can also be used easily between two size levels. For larger size jumps, special reducing jumpers are offered. In addition to pre-assembled comb-style jumper bars, the installer can also make individual comb-style jumper bars on-site by breaking individual pins out of the jumper. For complex switching, there are especially narrow staggered jumpers available. Two of these can be used in each jumper line.

#### ■ Easy labeling

All TOPJOB<sup>®</sup>S modules up to 6 mm<sup>2</sup> and 10mm<sup>2</sup> and 16mm<sup>2</sup> modules largely have the same contours and can be labeled continuously. The same applies for the X-COM<sup>®</sup>S 2020 and 2022 series in connection with TOPJOB<sup>®</sup>S modules up to 6 mm<sup>2</sup>. With the smartDESIGNER software tool from the free software package ProServe<sup>®</sup> and the thermotransfer

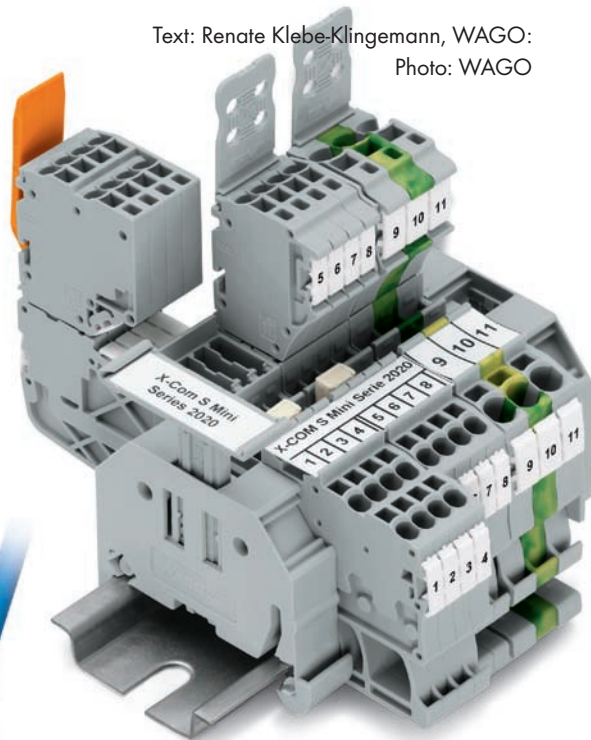
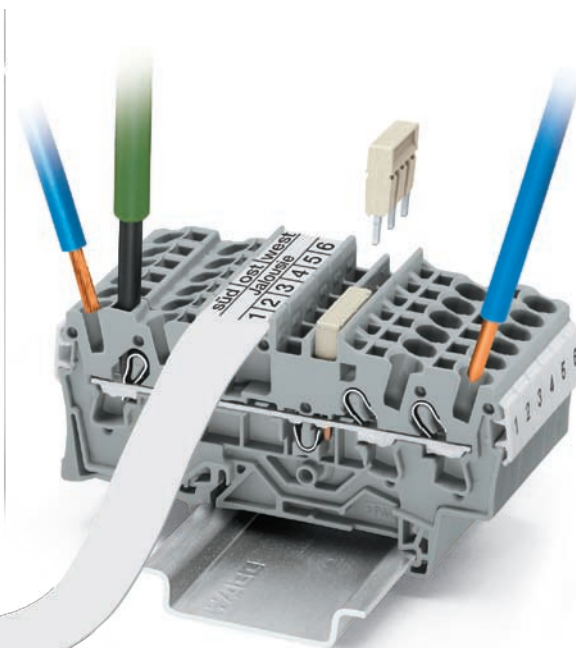
printer TP 298, a labeling sequence can be created especially cost-effectively and quickly. The printer also receives the data from the module configuration of the program and prints labeling strips or the familiar WMB-inline signs from the role. As a result, a whole rail-mounted terminal block rail can be labeled with a wave of the hand.

On the continuous and generously-sized labeling strips, you can print three-line group labels and thus achieve an especially precise assignment of the contact units.

#### ■ Conclusion

With the TOPJOB<sup>®</sup>S and X-COM<sup>®</sup>S the user has two systems attuned to one another that complement each other well. New, compact modules in the 3.5 mm grid save space on the DIN rail and nevertheless offer all advantages of the module program, such as the use of jumpers and a continuous labeling. Thanks to the similar contour of the modules, it is easy to create transitions from one system to the other. Whether you want a pluggable system that allows pre-assembly or a high connection density:— the system builder does not have to specify and he can choose according to the customer desires.

Text: Renate Klebe-Klingemann, WAGO:  
Photo: WAGO

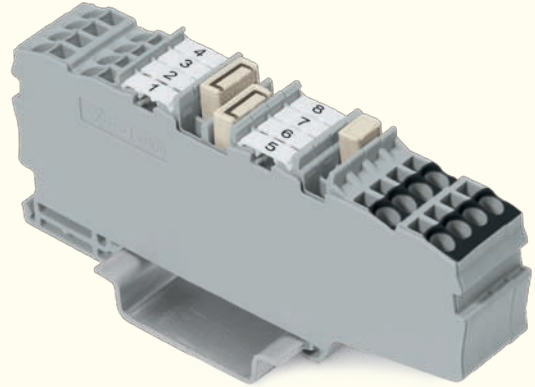




# THE NARROWEST RAIL-MOUNTED TERMINAL BLOCK SERIES IS EXPANDED:

## New double-decker through module in 3.5 mm width for TOPJOB®S

■ WAGO adds a double potential terminal block to the 2000 Series of TOPJOB®S rail-mounted terminal blocks. As the industry's most compact rail-mounted terminal block, it features two potentials on a width of just 3.5mm. The 2000 Series accommodates conductor sizes ranging from 0.14 to 1.5mm<sup>2</sup>. Furthermore, TOPJOB®S jumpers allow both potentials to be commoned with adjacent terminal blocks. Input and output of a circuit are placed on the same side of the terminal block. Color marking allows both circuits to be easily identified. Marking the circuits can also be performed using WAGO marker strips or WAGO WMB multi-marking system.



The new 2000 series double potential terminal block from the TOPJOB®S series is just 3.5 mm wide and allows potential com-

## QUALITY CONTROL:

### Partial unloading tests improve long-term safety of WAGO rail-mounted terminal blocks with use in photovoltaic systems

■ The turn away from the burning of fossil fuels toward regenerative energies leads inevitably to a new supply strategy: the few large centrally-located power plants are increasingly pitted against many small decentral systems. These include especially the photovoltaic systems that are being installed on more building roofs. The solar modules transform solar energy into electricity, which is then used directly on-site or fed into the public power grid.

WAGO's rail-mounted terminal blocks take on many duties in photovoltaic systems – for example as isolation equipment, cable collector or line connector. This Minden company is aware of its responsibility with respect to product safety without compromise. Therefore, all components that can also be used in photovoltaic systems are subjected to an additional testing process. With the so-called partial discharge test, the long-term security

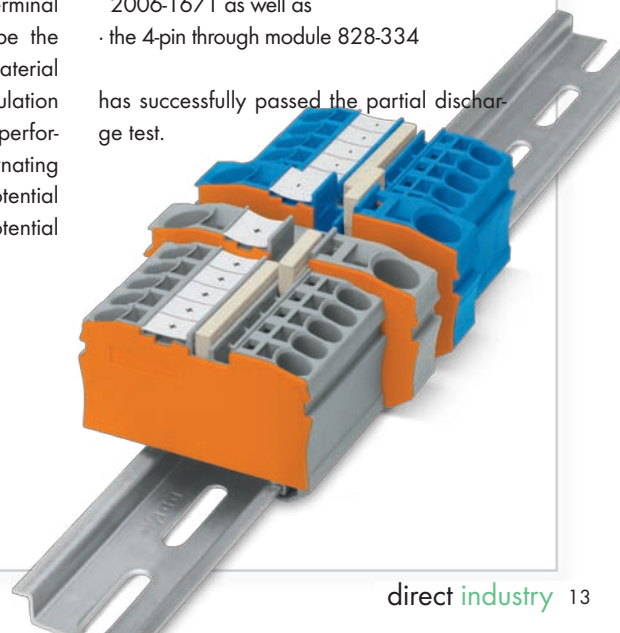
of the rail-mounted terminal blocks is proven up to 1000 Volts direct current.

The partial discharge test is necessary because high direct currents are present with the serial switching of photovoltaic modules. High voltages and accordingly high field strengths can cause micro-breaks in the insulation of the rail-mounted terminal blocks used. Low discharges can be the consequence, which then cause material fatigue and then the failure of the insulation line. The partial discharge tests are performed at WAGO with direct and alternating current and measured between potential and potential as well as between potential and housing.

All tested rail-mounted terminal blocks, including:

- the 2-wire through terminal blocks TOPJOB® Classic 782-601, TOPJOBClassic 782-601, ®S 2006-1201, TOPJOB®S 2016-1201,
- the 2-wire disconnect module TOPJOB®S 2006-1671 as well as
- the 4-pin through module 828-334

has successfully passed the partial discharge test.



# STEP BY STEP

■ Anyone who wants to print a document on both sides of the page with a local printer is familiar with the effort required to position the front and back side so they match nearly exactly. Things are even more difficult when the print medium is not a DIN-A4 sheet, but rather a cylinder of aluminum or PET (polyethyleneterephthalate). For such demanding production, printing plants are required that print color precisely down to the hundredth of a millimeter. The revolving transfer machines of ISIMAT GmbH Siebdruckmaschinen, assisted by WAGO stepper controllers can achieve this precision.

## ■ Decentral system design reduces line lengths

„Since we ourselves have created an innovation, naturally we wanted to use correspondingly innovative components – we found these in WAGO’s product portfolio,” remembers Norbert Fuchsloch, Development Director at ISIMAT. In the end, there was a concrete application for the WAGO-I/O-SYSTEM with the change from the central to the decentral machine controller: „Normally the stepper motors are addressed via actuators that are installed directly in the



1. Decentral PROFIBUS couplers exchange data between the controller and the sensors and actuators.



2. The positioning via stepper motors must allow printing with precision.

Since 1955, the name ISIMAT has stood for great expertise when it comes to screen printing: the machines that are manufactured in Ellwangen and delivered around the world print with great precision and repeatability – without losing quality across their entire useful life. Since Diplom-Ingenieur Peter Detzner took over the management of this traditionally-oriented company in 1995, ISIMAT has been positioning itself increasingly as an innovator: the developers at the company consistently use innovations from mechanical engineering, control technology, and feedback control to fulfill the requirements of industrial screen printing and even to exceed these. In this tradition, the revolving transfer machine inserts itself into revolving transfer printing, which is based on a still-new patent owned by this company in Ellwangen. It is used for the direct printing of cans made of plastic and metal in a special screen printing process; instead of printing on a banderole of paper, the motif is applied directly to the object in question.





# TO PRECISE PRINTING

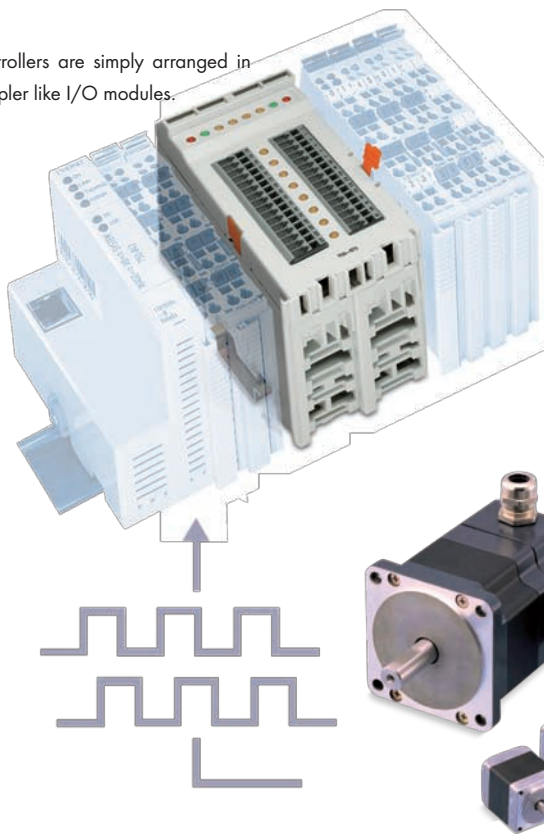
switch cabinet. This has the disadvantage that each motor in the machine and each actuator in the switch cabinet must be connected with a separate data cable. Then you have – in the truest sense of the word – under some circumstances a very, very long line. Added to this is the enormous space required in the switch cabinet, for such actuators are pretty big, at 150 x 120 x 80 mm,” explains Norbert Fuchsloch.



3. ISIMAT GmbH uses decentral PROFIBUS couplers and WAGO stepper controllers in its TH8130 rotary transfer machines. The new system design saves lines and mounting space in the switch cabinet.



The stepper controllers are simply arranged in series on the coupler like I/O modules.



- Easy to integrate: arranging stepper controllers like I/O bus modules
- Short line paths
- Slim set-up

#### ■ Stepper controllers simplify set-up and save space

In the rotary transfer machines, the control units with stepper controllers are installed decentrally in the machine, that is, in the immediate vicinity of the stepper motor in question. Eight control units with three stepper controllers apiece and the WAGO-I/O-SYSTEM 750 with PROFIBUS couplers control the positioning of the axes for the total of 24 motors – precisely, down to the hundredth of a millimeter. From the switch cabinet of the 4 x 4 meter machine, only the power supply and a fieldbus cable are required. This ensures efficiency in the cabling and minimizes the coupling in of disturbing signals. At the same time, this set-up produces significant space savings since the stepper controllers are much smaller than the components used previously. Added to this is that the parameterization is easier since the stepper controllers are addressed directly via the fieldbus. “Thanks to the modular nature of the WAGO-I/O-SYSTEM, we can react immediately to changed requirements for the manufacture of a rotary transfer machine,” emphasizes the Development Director at ISIMAT. He was persuaded not just by the technical data, but also by the good cooperation with the system supplier from the North Westfalian town of Minden. „Naturally the components fit our application precisely. However, it was just as important to us that WAGO helped us think and plan from the very start,” emphasizes Norbert Fuchsloch. Thus, their system advisors helped the engineering colleagues at ISIMAT to research a suitable manufacturer of stepper motors that are optimally suited for the area of application and work perfectly

together with the WAGO components. In the end, ISIMAT selected devices from Nanotec Electronic; they now control the rotary transfer machine via the stepper controllers. Two of the larger than life-sized printing machines are in use in Austria and print PET packaging such as plastic tubes and cosmetic pots. A few other rotary transfer machines for rotary printing are ready for delivery in our warehouse in Ellwangen.

Text: Stefan Keggenhoff, WAGO  
Photo: ISIMAT, WAGO





# EPSITRON® POWER SUPPLY SYSTEM EXPANDED

## New Modules Enhance Power Supply Reliability

■ With two new battery modules and a new redundancy module, WAGO's EPSITRON® power supply system now provides additional uninterruptible and redundant power supply designs.

WAGO's new DIN-rail mount 787-876 Battery Module features 1.2Ah nominal capacity and bridges short power outages lasting up to several minutes. Despite its compact design, the module incorporates robust AGM (Absorbed Glass Matt) batteries delivering short-term output current up to 7.5A. WAGO's EPSITRON® 787-870 UPS Module (24VDC, 10A) functions as charger and controller. Like WAGO's 7Ah and 12Ah battery modules, the new 787-876 Series has a miniature fuse holder accessible from outside the module.

The 3.2Ah battery module (787-871) has been upgraded to provide short-term, maximum peak current of 20A. The 787-871 module also incorporates a temperature sensor for controlled and soft battery charging.

Redundant power supplies significantly increase system availability. Redundancy modules control output voltage of parallel-connected power supplies, preventing reverse current and voltages drops when one of the power supplies fails. In addition to WAGO's 24VDC redundancy module (787-885), a 48VDC module (787-886) is now available that provides 2x20A load current. The new 787-886 Module is compatible with WAGO's 48VDC EPSITRON® PRO power supplies.



New battery and redundancy modules in the EPSITRON® power supply system make power supplies more reliable.

# LIGHT FOR SAFETY IN THE TUNNEL

■ In the canton of Zurich, the Gubristunnel leads to the northwest past Zurich between Weiningen and Regensdorf. This 3 km long tunnel is among the most-travelled roads in Switzerland. Since the lighting including the electrical sub-distribution was out of date, the construction ministry of the canton put the restoration out for bid. The company commissioned, IPT Elektro AG, persuaded the construction ministry with its design consisting of 72 wall boxes featuring maintenance-free WAGO spring terminals.

The Gubristunnel has been open to traffic since 1985. It is part of the A1 north bypass and connects the highways between St. Gallen-Bern (A1) and Winterthur-Lucerne (A4). Approximately 100,000 vehicles use this section of the highway every day, which is why it is among the most-used streets in Switzerland. Responsible for the construction planning and the maintenance of the road network in Switzerland is the Federal Ministry of Roads (ASTRA). In order to secure their functionality and implement the latest safety regulations, the ministry initiated the renewal of the 25-year-old electrical distribution. The canton's construction ministry put the project out for public bid and specified the use of spring pressure connection technology in the documents. Among other things, HDZ Elektroingenieure AG (HDZ) undertook the project and construction management for the renewal of the power supply and distribution, the lighting, and the safety equipment. IPT Elektro AG (IPT) of Birmensdorf, which did the electrical work, produced sample boxes in order to demonstrate the new distribution. Using the boxes, in an on-site appointment Frank Eichenberger, Managing Director of IPT, demonstrated the new electrical distribution with POWER-CAGE-CLAMP and TOPJOB®S rail-mounted terminal blocks from WAGO. In the end, the design and execution persuaded the people in charge of the construction.

## ■ Harsh environment requires maintenance-free contacting

The 3200 meter long tunnel consists of two directionally-separated tunnel tubes, which are connected to one another via 12 crossways. The electrical distribution for the electrification of the lighting is in the maintenance channel below the lanes. Here there are vibrations that can influence the contacting. „Electrical connections using screw clamps would have to be checked every 2 to 3 days and tightened up with a torque wrench,” reports Frank Eichenberger. In order to eliminate this work, the bid specified that maintenance-free spring pressure connection technology was required. With this technology, the conductor is pressed against the current bar in a defined contact area without damaging it. The clamping force adjusts automatically to the conductor size. Dynamic contact compensates for changes/movement of the conductor to eliminate the risk of a loose connection. In addition to the maintenance-free connection technology, the modules also had to be able to clamp large sizes, allow an easily-legible labeling, and provide easy commoning possibilities,” adds Christoph Lehmann, Managing Director of HDZ. These criteria apply to POWER CAGE CLAMP for sizes up to 95 mm<sup>2</sup> and to TOPJOB und auf TOPJOB®S up to 16 mm<sup>2</sup>. In addition, single-wire conductors without activation tool are plugged directly for rail-mounted terminal

blocks from the TOPJOBfen auf, die dreizeilig beschriftet werden können. Zudem werden bei Reihenklemmen aus dem TOPJOB®S program.

## ■ New distribution provides additional safety

Since 2008, there have been new operation and safety requirements in place that must be fulfilled. The new distribution stipulates that every tenth light must be supplied by a USP. Every other one of the 12 crossways is assigned to a line: all odd crossways supply the equipment in one tunnel, the even ones the others. In addition, the new lights can be dimmed in order to be able to adapt the light strength to the traffic and nevertheless remain energy-efficient. Experience has shown that after 8:30PM, there is only a little traffic on this stretch of road. Since sufficiently good light increases safety, the lights are now dimmed to 70-90% of the light strength instead of being switched off. The full light power is reserved for events such as

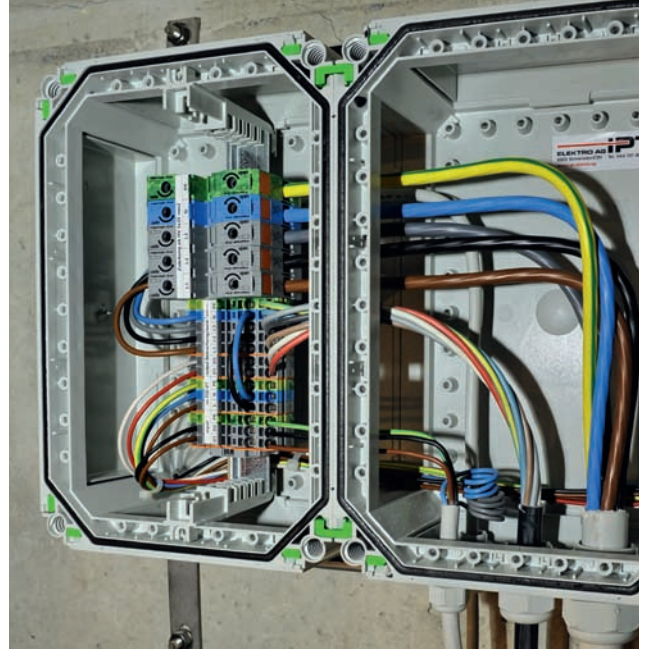
The Gubristunnel is part of the A1 north bypass and thus one of the most-used roads in Switzerland. New lighting ensures light and thus more safety around the clock.





an accident or a breakdown. With these specifications, IPT developed distribution boxes with feed modules and through modules for the required nominal sizes. „The 3-wire through modules of the 2006 series from the TOPJOB®S product range have a large nominal sizes of 0.5 mm<sup>2</sup> to 6 mm<sup>2</sup>. For the supply, the 35 POWER-CAGE-CLAMP is ideal: it clamps nominal sizes from 6 mm<sup>2</sup> bis 35 mm<sup>2</sup>. With both series, the required cross-sectional area is covered optimally,“ explains Frank Eichenberger. IPT installed 3-phase supplies approximately every 260m. The distribution is designed so that every tenth light in a string is always operating, even if all phases fail.

Text: Renate Klebe-Klingemann, WAGO  
Photo: WAGO



With just two rail-mounted terminal block series, sizes from 0.5 mm<sup>2</sup> to 35 mm<sup>2</sup> can be connected.



- Safer and maintenance-free CAGE CLAMP® connection
- Large connectable size range per series
- Large maximum conductor size (up to 95 mm<sup>2</sup>)
- Easy to label, multi-line labeling possible

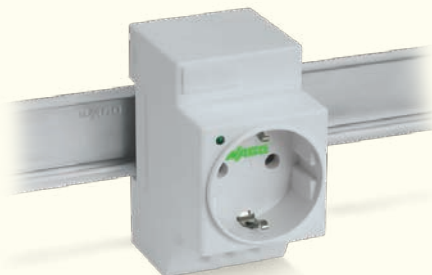


# NEW OUTLET FOR THE SWITCH CABINET

## Top hat rail outlets make working in the switch cabinet easier

■ Frequently, electric tools and test equipment are used when working in the switch cabinet. In order to be able to connect these directly in the switch cabinet, WAGO has developed a switch cabinet outlet (709-581). It is simply mounted on a DIN-35 rail in the cabinet and connected via CAGE CLAMP® connections to a conductor with a cross-section up to 4 mm<sup>2</sup>. The entry openings to the contact points are arranged at an angle in order to provide easier access and allow smaller laying radii. A LED installed in series production indicates that the outlet is ready for operation. In the housing, there is a holding fixture that contains a standard labeling strip; optionally, label carriers for labeling strips from the TOPJOB®S rail-mounted

terminal block program can be used in it. This way, the labeling of the outlet can be incorporated into the mechanical cabinet labeling using WAGO software such as smartSCRIPT. The outlet is designed for 16 A and 250 VAC and by default, it is gray. For areas in which after switching off the main switch equipment may still be energized, a marking of this circuit may be necessary. For this, there is an outlet in a yellow housing. At first the outlet will be available with an isolated ground receptable, additional country variants are planned.



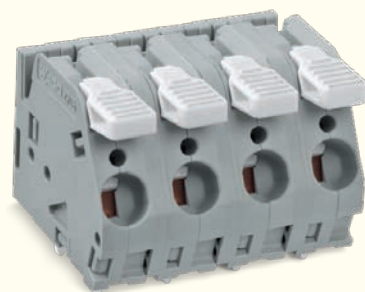
New WAGO switch cabinet outlet: easy handling thanks to CAGE CLAMP® connections and angled entry openings. Also equipped in series with LED, for display of the operational readiness.

# WIRING CIRCUIT BOARDS CONVENIENTLY:

## New High-Current, Lever-Actuated PCB Terminal Strips

■ WAGO is expanding the line of high-current terminal strips with actuation levers. The new 2706 Series (10 AWG/6mm<sup>2</sup>) joins the 2716 Series high-current PCB terminal strips (6 AWG/16mm<sup>2</sup>). The 2716 Series' integrated levers provide tool-free actuation of the clamping units for convenient, time-saving and intuitive operation. This type of operation is not just easy and time-saving for the user, but also self-explanatory. Using CAGE CLAMP® connection technology, the clamping unit closes all the way automatically when the lever is lowered and the right contact pressure is adjusted, providing durable and reliable connections.

Several clamping units can be held open simultaneously, providing convenient termination of multi-core cables. Two solder pins per pole (2706 Series), and four solder pins per pole (2716 Series) provide high mechanical stability on the PCB. The terminal strips are available in 2- to 12-pole configurations, as well as different colors and mixed-color terminal strips for unique pole assignment. Terminal strips featuring pin spacing greater than 12.5mm are UL-rated at 600V. Furthermore, versions with jumper slots for potential distribution are also available for 7.5 and 10mm pin spacing.



New high-current, lever-actuated terminal strips with CAGE CLAMP® connection



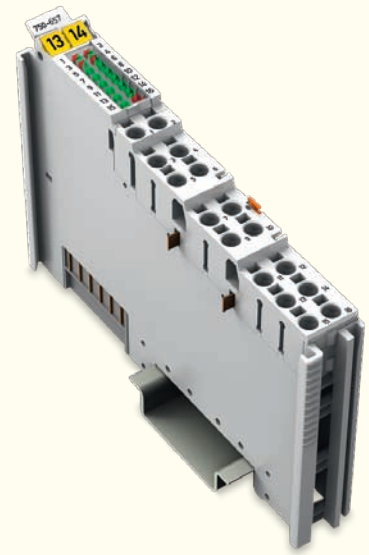
# IO-LINK MASTER MODULE:

## Integrate sensors and actuators easily

■ With IO-Link there is a high-performance standard available that easily integrates the entire product line of sensors and actuators into automation concepts. The new 750-657 IO-Link Master Module from WAGO offers four channels based on this standard in a 1/2 inch (12mm) wide module housing. This way, four different IO-Link devices or digital standard sensors/actuators can be simultaneously integrated into the automation using the WAGO-I/O-SYSTEM.

The IO-Link master module provides a 3-wire connection that can communicate process data as single bits, bytes and data blocks for input and output data with up to 230.4 kbaud per sensor and actuator. For the identification, configuration, parameterization,

and diagnosis of the IO-Link devices, there is also an acyclical service available. Each of the four channels is equipped with CAGE CLAMP® connections and thus offers easy handling. Device description files for master and devices define their functions and performance data. The software tool WAGO-IO-CHECK assists the user in making any adjustments. If a device must be replaced, the configuration and parameterization can be restored automatically without the intervention of maintenance personnel. Project design, installation and operation are thus simplified significantly. Together with the coordinated configuration and parameterizing software, various cabling and time-consuming integration into the control unit are things of the past.



The IO-Link master module from WAGO incorporates four IO-Link devices or digital standard sensors/actuators into the automation using the WAGO-I/O-SYSTEM.

# EPSITRON® POWER SUPPLIES:

## Low-Profile COMPACT Power Supplies

■ Effective immediately, new, low-profile power supplies are joining WAGO's EPSITRON® power supply system. The 55mm-high units can be mounted in installation and distribution boxes, as well as in flat control panels or system housings. Small yet powerful, the 787-10xx COMPACT Power Supplies (30W, 60W and 100W) provide 12 and 24VDC output voltage. They offer protection class II and feature a wide input voltage range of 85–264VAC for use in different supply networks, or networks with voltage tolerances. The housing complies with DIN 43880 and is available in 54mm, 72mm or 90mm widths, depending on the power class. Depending on the performance class, they are 54 mm, 72 mm or 90 mm wide. Overhead installation capability (with derating) and low-profile design (55mm height from upper-edge of DIN 35 rail)

make the units ideal for supplying WAGO-I/O-SYSTEM 750 or similar control systems in distribution boxes. The power supplies are connected via color-coded and clearly marked compact terminal blocks equipped with maintenance-free CAGE CLAMP® connections. Furthermore, the units feature front-panel status indication and adjustable output voltage (e.g., to compensate for voltage drops over long lines). WAGO's COMPACT Power Supplies meet both UL 60950 and UL 508 standards for use in export-oriented plant and machinery industries.



WAGO is expanding the EPSITRON® power supplies to include COMPACT-Power power supplies 787-10xx with a profile of just 55 mm.

# SAFETY IS NOT A

PROFIsafe makes the production of lottery scratch tickets safe



■ Gallus Stanz- und Druckmaschinen GmbH installed one of the most powerful inline machine systems for producing scratch tickets in September 2009. In order to guarantee the safety of this powerful machine, which consists of more than 20 printing units, the persons responsible are betting on PROFIsafe modules by WAGO.

Although games of chance are probably as old as humanity itself, they have not lost their popularity. To the contrary: nowadays, the lottery is popular, for example scratch tickets. However the production of these lucky tickets is more work-intensive than one might believe – and it demands large and complex machines. Such ones as Gallus Stanz- und Druckmaschinen GmbH develops for its customers around the world. The experts at Gallus Stanz- und Druckmaschinen GmbH already transferred a production facility with an annual capacity of more than ten billion scratch tickets to their customer in the USA in May 2009. The second such facility of this type, which was completed in September of that year, went to Canada.

With the PROFIsafe modules by WAGO, the safety-related and non-safety related signals communicate via one and the same fieldbus.



# A GAME OF CHANCE

## ■ Inseparable: quality, time, safety

Gallus is working with trusted suppliers, in order to cope with such complex projects at a more consistent quality and within a reasonable time frame. One of these is WAGO. „We have been installing WAGO products in our systems for many years, including the rail-mounted terminal blocks with the patented CAGE CLAMP® technology, the fieldbus-independent WAGO I/O SYSTEM and various relay modules,“ says Paul Bäumler, project engineer and CCS product manager at Gallus Stanz- und Druckmaschinen GmbH.

Gallus relied on another WAGO component when planning and designing the machine system for the production of scratch tickets for the Canadian market: the PROFIsafe modules of the WAGO I/O SYSTEM. „We were able to implement the decentralized safety functions over the entire system by using safety terminals from WAGO in the simplest way and provide it with a central safety control unit“, according to the project engineer.

The enormous dimension of the machine system with an overall length of an impressive 100 meters generally made this necessary. More than 20 flexography units produce the lottery tickets in the in-line process at speeds of more than 300 meters per minute, therefore from the roll up to the finished product in one pass. Each printing unit is equipped with its own safety functions for the emergency stop circuit, monitoring of the supply and exhaust valves of the gas heater, the motor authorizations and against undesirable voltage fluctuations.

## ■ Development options: yesterday, today, tomorrow

Not so long ago, this was very different. A fully automatic large-scale production of scratch tickets was technically impossible. Trained personnel had to accompany the process and remove the material from a printing unit and place it in the next unit: from applying the insulating layer to the rubber coating and on to the final four-color printing process. The safety features of each printing unit was implemented with in-house wired safety relays and was discretely wired.

Today, with the PROFIsafe modules by WAGO, the safety-related and non-safety related signals communicate via one and the same fieldbus, via a PROFIBUS DB in case of the Canadian facility. „Here, the customer could also have decided on PROFINET, since both protocols are supported. We precisely appreciate this flexibility in the remaining WAGO components; We do not have to decide on a fieldbus, but can decide on another innovative fieldbus technology at any time with the proper bus couplers“, Bäumler summarizes one of WAGO's decisive advantages.

Text: Stefan Keggenhoff, WAGO  
Photo: Gallus



Each of the 20 printing units is equipped with its own safety functions for the emergency stop circuit, monitoring of the supply and exhaust valves of the gas heater, the motor authorizations and against undesirable voltage fluctuations.



The production of scratch tickets is time-consuming and demands large and complex machines. Flexography units produce the lottery tickets in the in-line process at speeds of more than 300 meters per minute, therefore from the roll up to the finished product in one pass.

- Only one I/O system for PROFIsafe and standard modules
- Fieldbus-independent and modular
- Scalable according to the customer's requirements

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## IMPRINT

### WAGOdirect industry March 2011

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