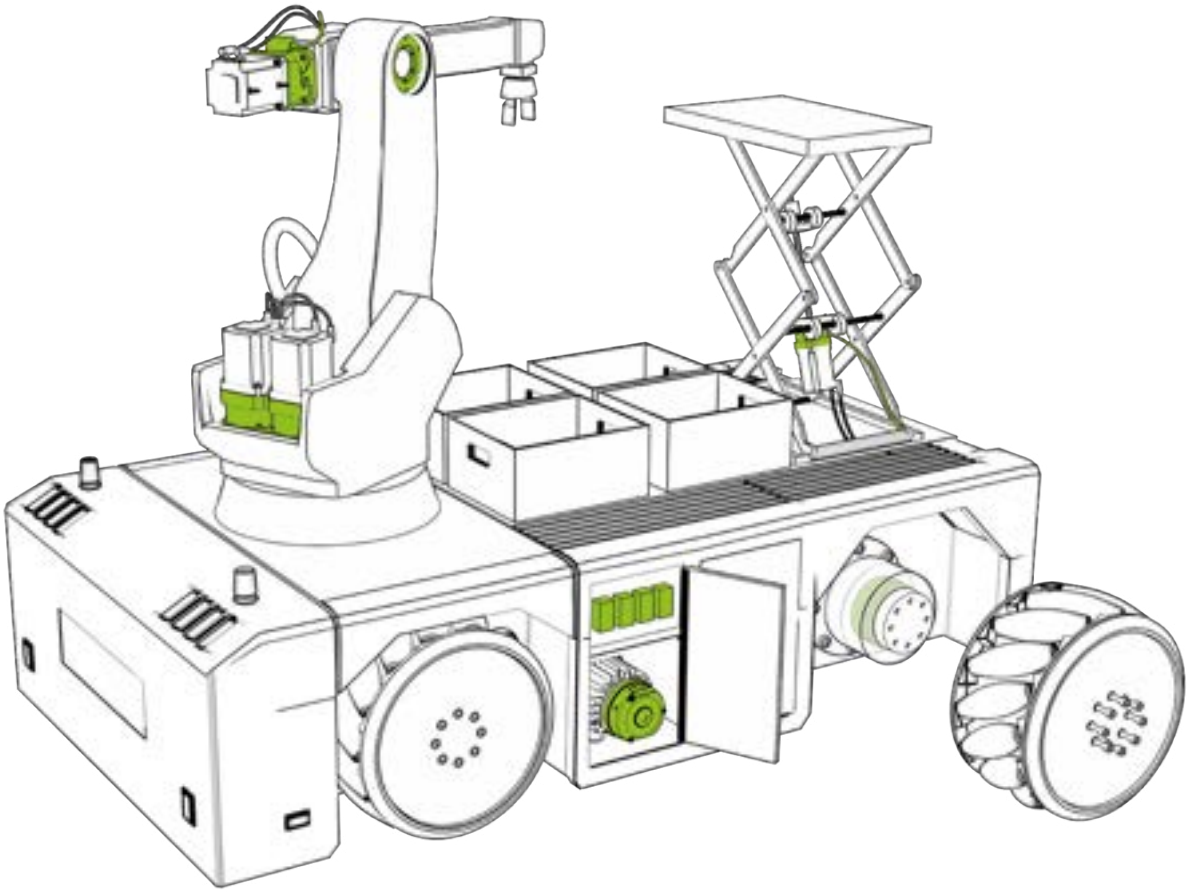
mayr®

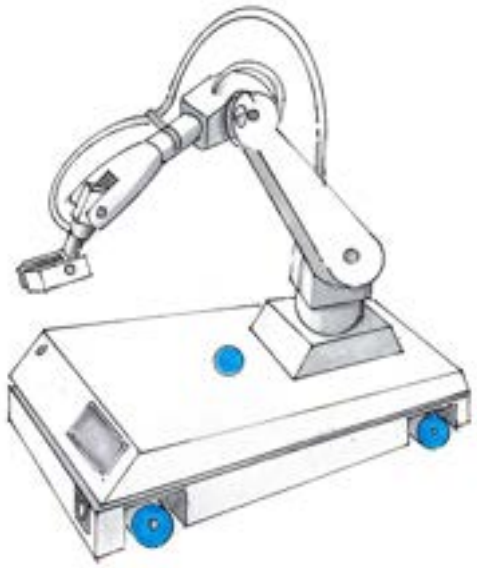
SAFETY BRAKES FOR *AUTOMATED GUIDED VEHICLES (AGVS)*

www.mayr.com

Picture credits

Title: shutterstock/vanitjan; Page 3, drawing: Michael Paetow; Page 11: Etisoft Remaining: *mayr*® power transmission



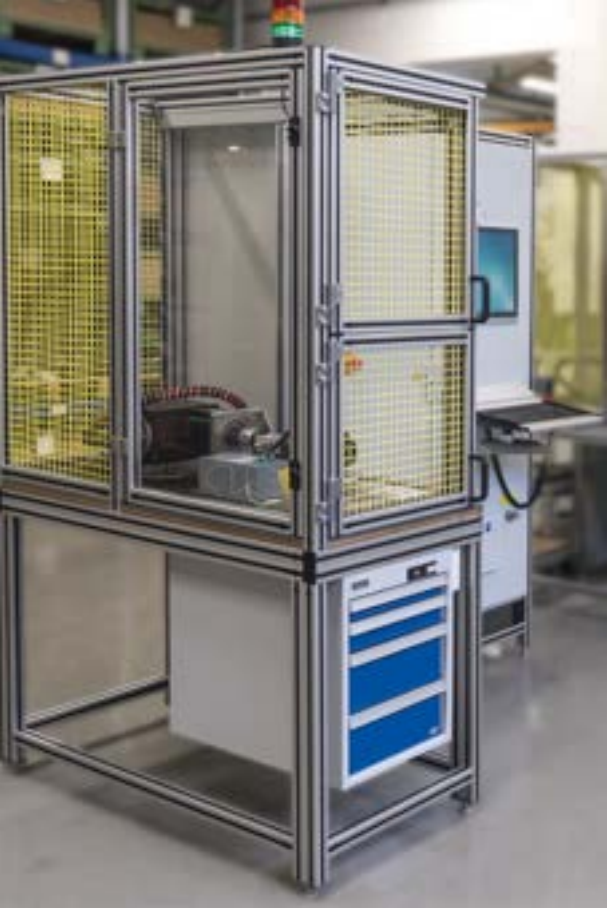


Reliable safety brakes for Automated Guided Vehicles (AGVs)

For more than 125 years, the company *mayr*® power transmission has stood for innovation and premium quality. The family-run company from the Allgäu region can rely on decades of experience in development, manufacture and application, and still has a major influence on power transmission with its pioneering products.

To ensure that Automated Guided Vehicles (AGVs) always stop purposefully on their way through factory halls and do not cause any damage to material or even injure people, reliable and accurately operating safety brakes are indispensable. *mayr*® power transmission offers a wide range of products for exactly this purpose, as in addition to the ground-level battery-powered traction drive, it is also necessary to safeguard the movements of e.g. robotic superstructures or hoisting devices. The brakes used in AGVs have to be compact, but must also feature high performance density, wear resistance and, if necessary, networkability.

mayr®
your reliable partner



Expert know-how in development and design

As the technological leader, *mayr*® power transmission focuses on continuous further development. Today, highly qualified engineers and technicians work on tomorrow's innovations using the most up-to-date tools. The many years of experience and countless tests in the Development and Testing Department at the Mauerstetten Headquarters form the basis of conscientious lifetime dimensioning.

The values upheld by our traditional, family-run company also include long-term stability and independence as well as a good reputation and satisfied customers.

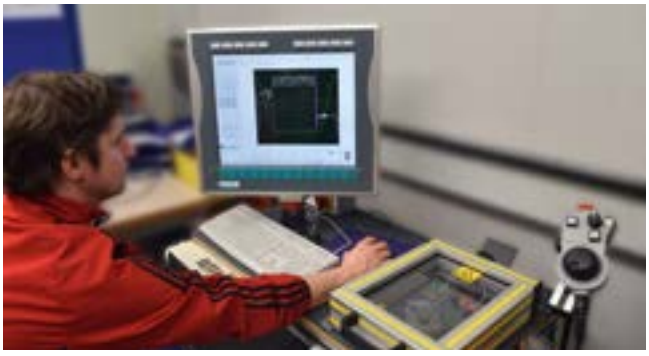
Therefore, we place emphasis on:

- Tested product quality,
- Optimum customer service,
- Comprehensive know-how,
- Global presence,
- Successful innovations and
- Effective cost management

Tested quality and reliability

mayr® brakes and clutches/couplings are subject to meticulous quality checks. These include quality assurance measures during the design process as well as a comprehensive final inspection. Only the best, tested quality leaves our factory. All products are rigorously tested on test stands, and adjusted precisely to the requested values. An electronic database in which the measured values are archived together with the associated serial numbers guarantees 100 % traceability. On request, we confirm the product characteristics with a test protocol.

The certification of our quality management according to DIN EN ISO 9001:2015 confirms the quality-consciousness of our colleagues at every level of the company.



Specialists in power transmission for more than a century

mayr® power transmission is one of the most traditional and yet most innovative companies in the field of power transmission. From modest beginnings in the year 1897, the family enterprise has developed to become the world market leader. Worldwide, the company employs more than 1350 people.

An unsurpassed standard product range

mayr® power transmission offers an extensive variety of torque limiters, safety brakes, backlash-free shaft misalignment compensation couplings and high-quality DC drives. Numerous renowned machine manufacturers trust in solutions by *mayr*® power transmission.

Represented worldwide

With eight subsidiaries in Germany, sales offices in the USA, France, Great Britain, Italy, Singapore, Japan and Switzerland as well as 40 additional country representatives, *mayr*® is available in all important industrial areas, guaranteeing optimum customer service around the globe.

Never compromise on safety

We make no compromises where safety is concerned. Only top products of a perfect quality guarantee that no people are injured or machines damaged in case of malfunctions, collisions and other hazardous situations. The safety of your employees and machines is our motivation to always provide the best and most reliable clutches, couplings or brakes.

mayr® power transmission holds numerous ground-breaking patents, and is the global market or technological leader for

- application-optimized **safety brakes,** for example for passenger elevators, stage technology and gravity-loaded axes
- **Torque limiters** to protect against expensive overload damage and production losses and
- backlash-free **servo couplings.**

Strongly positioned

mayr® sets standards in power transmission with economically viable solutions. For maximum competitiveness of your machines and systems, we always aim for the best possible cost efficiency, starting with the development of your clutch/coupling or brake, right up to delivery of the finished and inspected product. For cost-efficient production, our factories in Poland and China represent the perfect supplement to the headquarters in Germany.

mayr® headquarters in Mauerstetten: Climate-neutral since 2020

Subsidiary with Production — *mayr*® China

Subsidiary with Production — *mayr*® Poland

Safety brakes for Automated Guided Vehicles (AGVs)

A variety of application fields – a variety of requirements

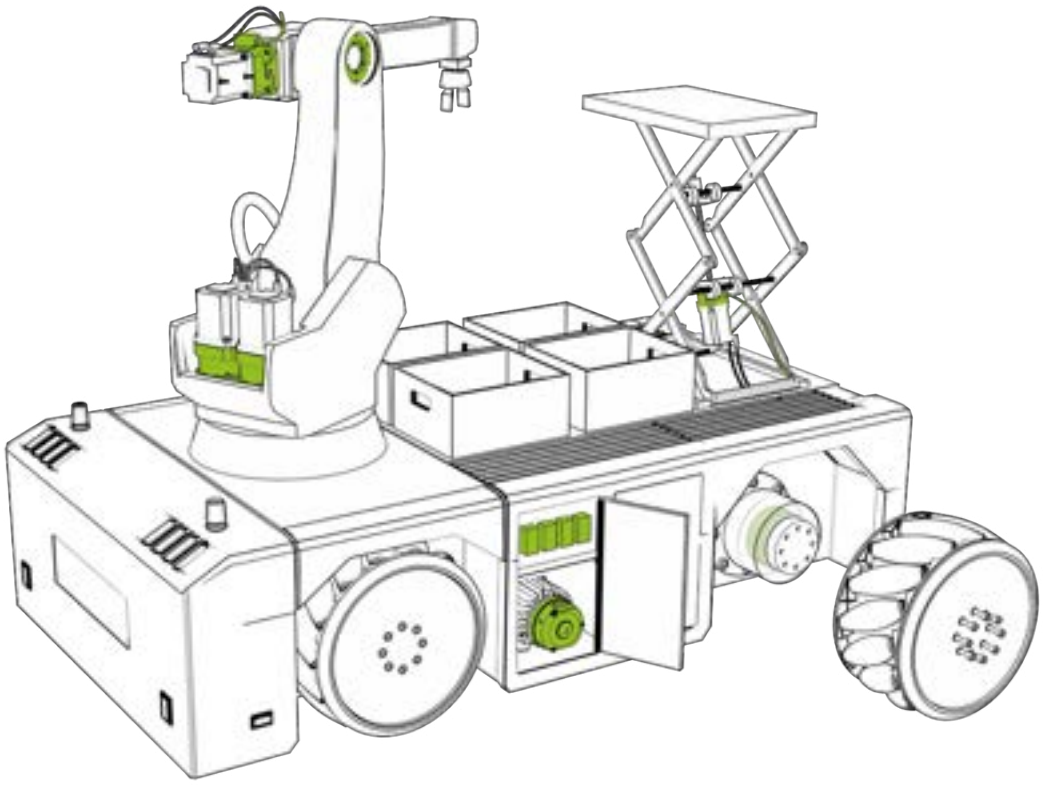
Automated Guided Vehicles (AGV) are on the rise and have by now become a permanent fixture in modern intralogistics. After all, wherever standardized transports take place, processes can be automated using automated guided vehicle systems (AGVS) – i.e. the combination of several AGVs via a master control system. Today, AGVs perform a wide range of tasks and are used in many different areas.

The requirements are just as extensive – including for the safety brakes. As there is no single brake for every application scenario, *mayr*® power transmission provides flexible solutions for a wide variety of drive concepts and installation situations.

All brakes used in AGVs must not only be compact, but also high performance and wear resistant. The *mayr*® brakes are designed in such a way that the installation space is optimally used and as much energy as possible is saved or as little energy as possible is consumed.

It is also important that all brakes can be operated with battery voltage or safety extra-low voltage and also function reliably despite fluctuating battery voltage.

In addition, various release monitoring systems, including sensorless ones, as well as the safety parameters are also available for all brakes. It is possible to achieve the performance level ≥ d (according to DIN EN ISO 13849).



Safety due to the fail-safe principle

In addition, the brakes must also work effectively in the event of a failure or interruption of the power supply, or if the steering or speed control fails. Safety brakes according to the fail-safe principle are the first choice for this. As these brakes are closed in de-energized condition. They provide the required braking torque even in the event of an emergency stop, a power failure or in case of an interruption in the power supply caused by cable breakage, for example. To ensure that the safety brakes also provide sufficient friction work in emergency stop situations and brake movements with a defined braking torque, a friction lining developed for this purpose with a corresponding steel counter friction surface is required. While this is common with safety brakes, permanent magnet brakes with their steel-on-steel friction combinations reach their tribological limits here.

Short switching times are essential for achieving short stopping distances, particularly for AGVs. Brakes by *mayr*® therefore have short, verified switching times that are maintained over the entire lifetime of the brake.

The use of sealed designs with increased IP protection is recommended because the ingress of dirt or liquids could impair the function of the brakes. In the case of integrated brakes, however, this protection can also be provided by the surrounding housing.

Integration options for safety brakes in the chassis

ROBA-stop®-M, ROBA®-servostop® and ROBA®-alphastop® brakes

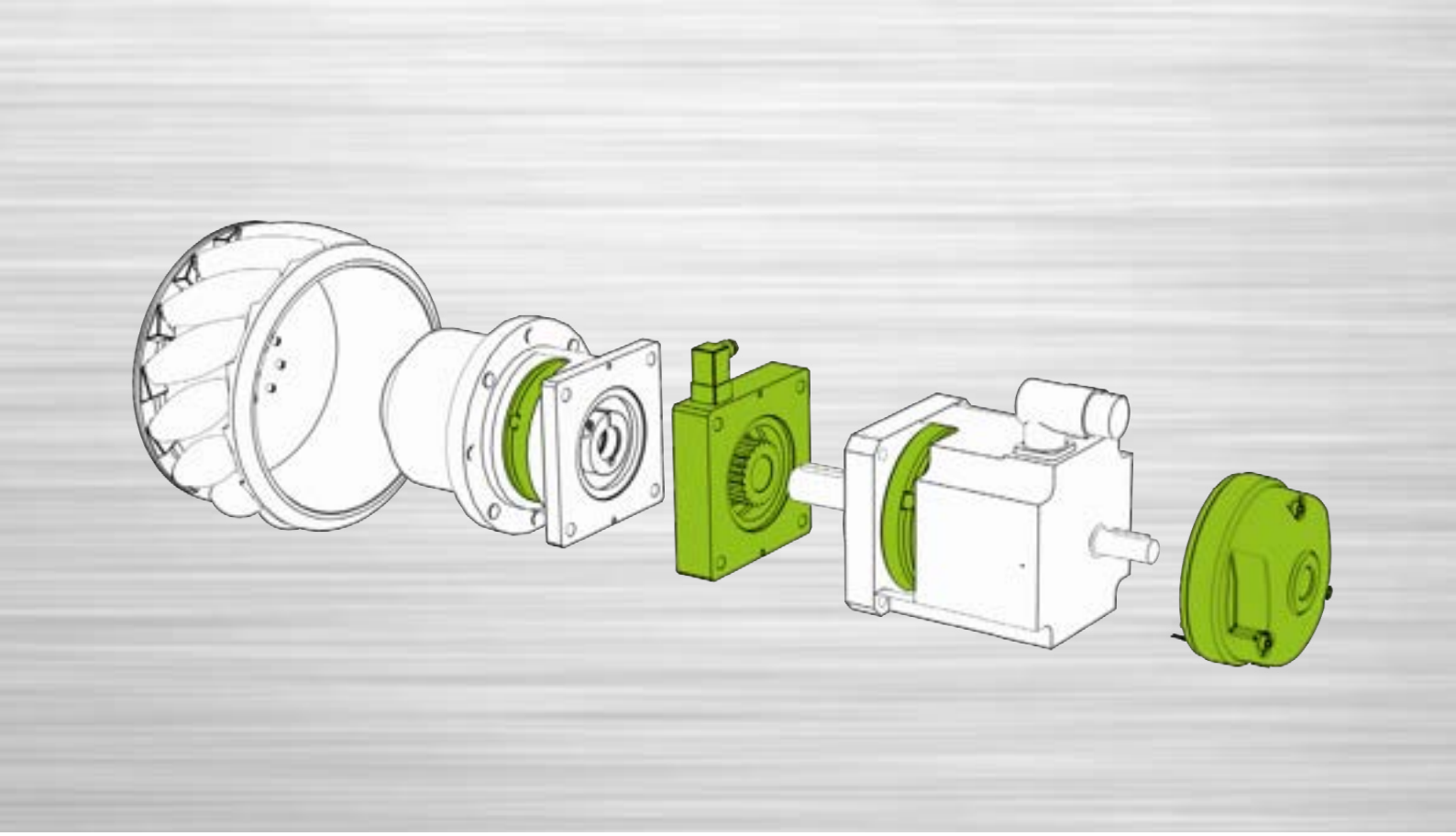
Integrated safety brakes – lean and light

ROBA®-servostop® brakes are recommended for integrated safety brakes, i.e. directly in the wheel drive or in the servomotor, for example. These brakes are not only very lightweight and slim, but also extremely fast when it comes to magnetic actuation. Furthermore, the brakes impress users with their high permitted friction work during dynamic braking actions. *mayr®* power transmission provides safety parameters for the ROBA®-servostop® brakes. In addition, these brakes are designed in such a way that the installation space is optimally used and as much energy as possible is saved.

There are three designs of ROBA®-servostop® brakes. *Classic* for high braking torques and with very good dynamic properties. *Lean* – a version optimized to the installation space with a particularly lean design. And *Cobot* for connecting hollow shafts and ideal for integration into joints of lightweight robots.

Robust motor brakes – Protected against dirt

If, however, the brakes are not used in a closed but in an open power transmission system or on the outside of the AGV, where they are exposed to dust and dirt, the robust ROBA-stop®-M motor brakes are the ideal choice. They are conventionally mounted on the B-bearing side on the motor and are available in closed and sealed designs with IP 66 protection. This industrial brake not only comes with safety characteristic ratings, but also many standard options and approvals. It is available as dynamic and holding brake.



A true “go-between”: ROBA®-alphastop®

Brake modules such as the ROBA®-alphastop® are installed between the gearbox and motor

- Easy installation
- Only the motor shaft may have to be extended
- Without additional bearing
- Particularly light and lean
- Customer-specific protection class
- Also available with output shaft or backlash-free shaft coupling

Product Catalog

The detailed Product Catalogs with all constructional designs, technical data and dimensions are available for download on our website **www.mayr.com**.

Go to the ROBA®-stop®-M catalog
(K.891.V_)

Go to the ROBA®-servostop® catalog
(P.898000.V_)

Go to the ROBA®-alphastop® catalog
(P.897.V_)

mayr®
your reliable partner

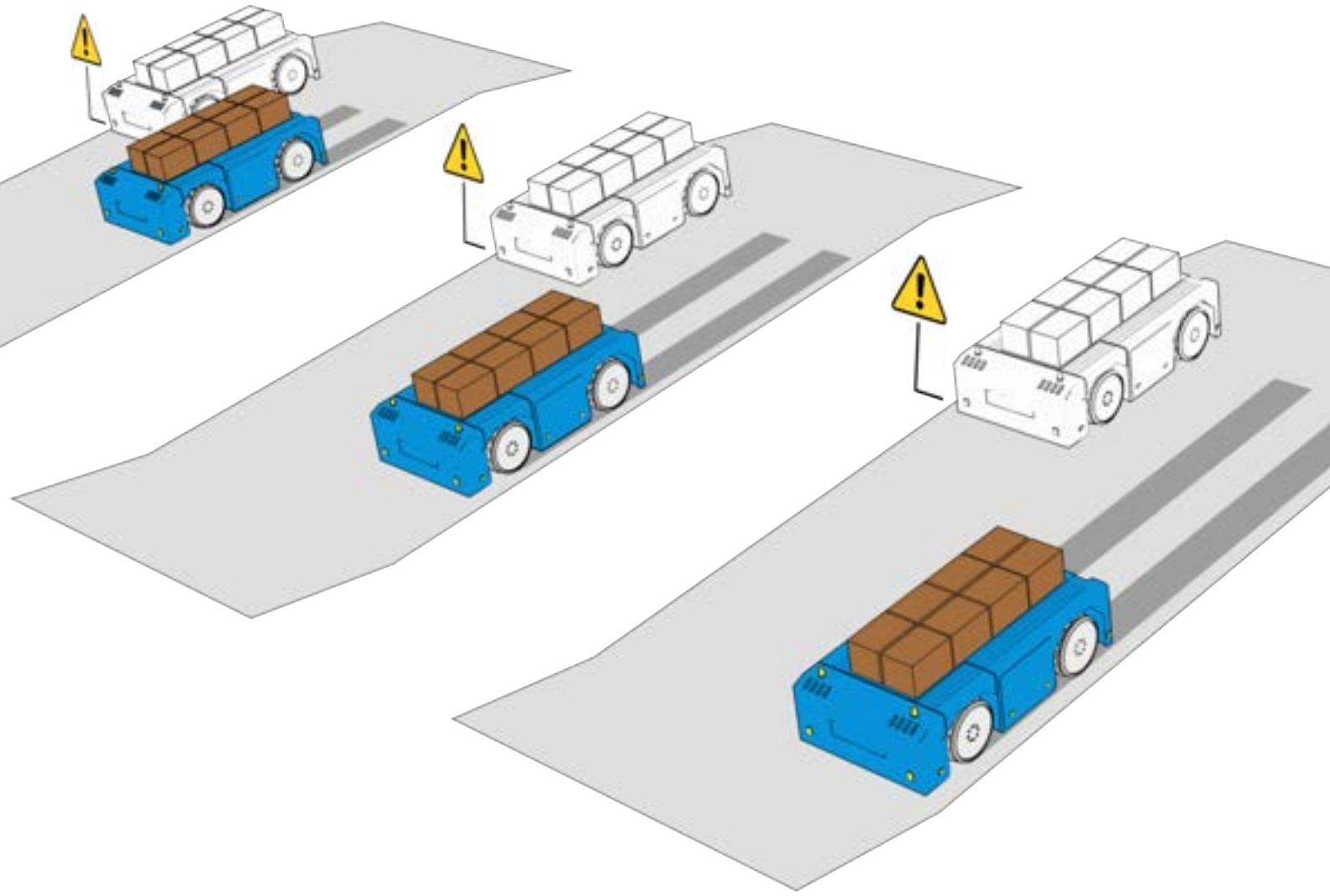
Safety brakes for Automated Guided Vehicles (AGVs)

Requirements resulting from standards and guidelines

Today, AGVs perform a wide range of tasks and are used in many different areas. The requirements resulting from standards and directives, and which must be observed when selecting the brakes, are equally extensive. So for example, the braking system must be able to bring the Automated Guided Vehicle (AGV) and unbraked trailers to a standstill and hold them within the sensor range (detection of persons) even under unfavorable conditions such as speed, slope, nominal load, etc. This is the only way to prevent collisions. In addition, the brakes, as described, must also work effectively in the event of a failure or interruption of the power supply, or if the steering or traction drive control fails.

Electromagnetic safety brakes from *mayr*® power transmission also have the safety parameters that are required for the safety assessment of machines that are subject to the Machinery Directive. This also applies to the traction drive of AGVs. To achieve the performance level ≥ d (according to DIN EN ISO 13849), the deceleration function and the stopping of all movements in the event of an emergency stop even require several (redundant) safely controlled brakes with release monitoring as actuators.

Relevant standards include, for example, the type A standard DIN EN ISO 12100, which describes, amongst other things, how the risk analysis is to be carried out and how the risk is to be minimized in terms of design. The type B standard DIN EN ISO 13849 for functional safety and the specific type C standard DIN EN ISO 3691-4 for safety-related requirements for driverless industrial trucks. In addition, other standards may be relevant, for example if vehicles are fitted with robotic assemblies or are to be used in areas where there is a high danger of explosion.



Side note: Determining the stopping distance

As is the case when driving a car, for example, the stopping distance, i.e. the distance that a vehicle actually needs to come to a standstill, is also decisive for AGVs. If the vehicle is driven by a driver, the stopping distance consists of the reaction distance (the distance the vehicle continues to travel unbraked until the driver reacts) and the actual braking distance from the moment the driver actually steps on the brake.

In theory, without a driver, the reaction distance is no longer relevant, and the brake would immediately engage and decelerate the vehicle if required. In reality, however, each brake has a certain time delay or switching time, the so-called t1 time, during which the braking torque builds up. Add the time delays of the upstream sensor system, the control system and the brake contactor.

This means that the brake does not engage immediately when required, but is delayed by these time delays of the system and the switching time of the brake. And during these time delays, the AGV continues to move of course, or even accelerates, e.g. due to a downhill slope. In both cases, the braking distance gets longer.

Short, verified switching times

The situation is made worse by even longer time delays and switching times and/or incorrectly dimensioned safety brakes.

In the case of vertically moving axes, e.g. in cranes or robot arms, the brakes can become thermally overloaded due to the increase in speed or rotational speed in free fall in the worst case.

This further extends the braking distance or ultimately even causes the load to crash. The slope that usually occurs around AGVs is, of course, far from free fall. Nonetheless, the subject should be kept in mind when selecting a braking system.

Users should therefore pay attention to verified switching times which are as short as possible when selecting brakes – and also assure themselves that these switching times can be maintained throughout the entire service lifetime of the brake. Reliable monitoring solutions are important for this.

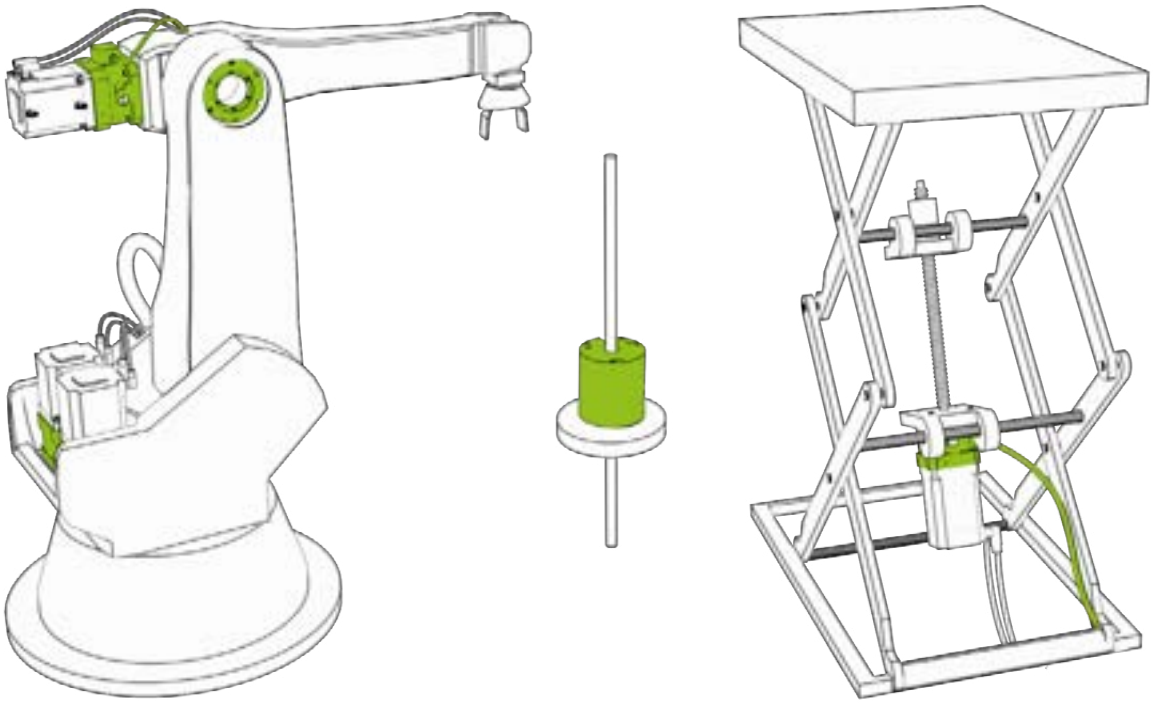
Integration options for safety brakes in superstructures

ROBA®-topstop®, ROBA®-servostop® Cobot and ROBA®-linearstop® brakes

In addition to the chassis, AGVs include various assemblies for handling material, such as lifting devices or robots. Here too, the potential risk can be minimized by using safety brakes. For example, with the ready-to-install plug-and-play brake module ROBA®-topstop®, in lifting devices, e.g. for direct spindle connection or in robots between the servomotor and gearbox. The braking system holds the vertical axis safely in any position, even if the motor is disassembled for maintenance or transport. The axis does not have to be additionally supported, which considerably accelerates the replacement of the drive motor, for example. Thanks to its adapted flange dimensions, the brake can also be easily integrated into existing constructions. The safety brake meets high IP standards and is currently available up to Protection IP65. It is therefore already adequately protected against the ingress of grease or oil mist.

Standard modular system for robot brakes

ROBA®-servostop® brakes have proven themselves in the joints of lightweight robots – as well as in the traction drives of AGVs. The standard modular system doesn't only create a high degree of flexibility for the various installation situations. It also provides users with easy and uncomplicated access to the brakes and a quick overview of the individual solutions.



Securing linear movements reliably

Linear movements are often safeguarded with safety brakes, which have an effect on separately attached cylindrical piston rods. *mayr*® power transmission is the only manufacturer to offer electrically opening linear brakes which are also safety brakes. This means, the brakes operate according to the fail-safe principle. They generate the braking force through thrust springs and are closed in de-energized condition. Most linear brakes available on the market today act as static clamping units and have only been designed to hold the axes at a standstill. However, if the drive fails completely, the linear brake is also responsible for the reliable deceleration of the load. Which is why the *mayr*® power transmission safety brakes are also designed for such dynamic braking situations. The company has voluntarily subjected the brakes to a type examination as a safety component in accordance with the Machinery Directive (2006/42/EC).

Product Catalog

The detailed Product Catalogs with all constructional designs, technical data and dimensions are available for download on our website **www.mayr.com**.

Go to the ROBA®-topstop® catalog
(K.899.V_)

Go to the ROBA®-servostop® catalog
(P.898000.V_)

Go to the ROBA®-linearstop catalog
(K.381.V_)

mayr®
your reliable partner

Electrical components for brakes in AGVs

Intelligent safety through networked machine elements

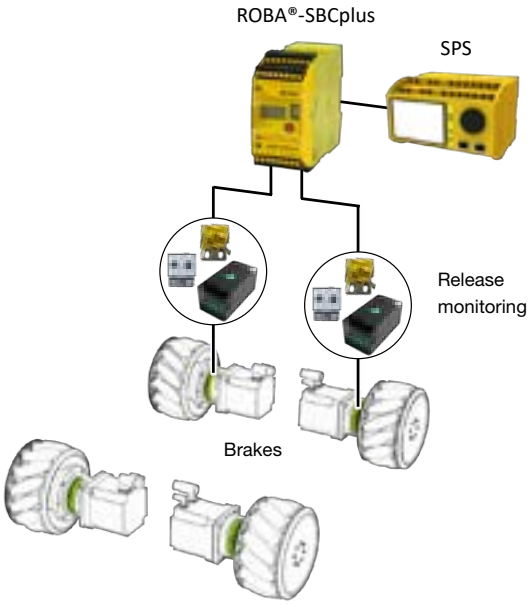
mayr® power transmission offers a comprehensive range of electrical accessories for controlling and monitoring the safety brakes. These include, for example, the ROBA®-switch rectifier or the smart module ROBA®-brake-checker. The latter provides regulated output voltage for different battery voltages and can also keep the overexcitation voltage constant. This not only enables a very good dimensioning of the brakes, but with the module it is also possible to supply the brakes in a stable manner and thus to operate them safely in any operating state, i.e. also despite falling or changing battery voltage: so, even if the battery discharges, the brake is still always opened safely.

In addition to controlling the brakes, the ROBA®-brake-checker module is also responsible for monitoring them. In an extended version, the ROBA®-brake-checker is equipped with an additional PCB with a customer-specific interface (e.g. Ethernet based). Via this interface, it can provide data on the switching time, current, voltage, resistance, performance und relative attraction current. This means that processes can be evaluated, anomalies in the process can be detected quickly and conclusions can be drawn from complex interrelationships – an advantage, not just for predictive maintenance, but also for the interaction of robots, transportation and warehouse logistics. Furthermore, integration into remote maintenance systems is also possible.

Safe brake control with ROBA®-SBCplus

The safe brake control ROBA®-SBCplus is used to control and monitor safety brakes, especially in AGV applications, which have requirements regarding functional reliability, such as for example ISO 13849 and IEC 62061.

- Safe brake control via semiconductors; practically unlimited switching frequency and reliability
- Switching and monitoring of two independent brake circuits for applications up to PLe and SIL CL3
- Diagnostic functions configured at the place of manufacture enable checks for internal errors or errors in the brake =>diagnostic coverage
- Simple integration and reduced effort to achieve a performance level
- TÜV Süd (German Technical Inspectorate) type examination tested, UL-approved



Good to know: Saving energy through smart control

The smart control of the brakes with a ROBA®-switch rectifier or the control and monitoring module ROBA®-brake-checker provides great energy saving potential. As the brake is only energized with high voltage for a short time when it is switched on. In this phase, a high magnetic force is required to attract the armature disk via the air gap. However, once the armature disk is in contact with the coil carrier, significantly less magnetic force is sufficient to keep the brake open. For this reason, the voltage can be significantly reduced in this phase. If the rectifier lowers the voltage to a third after the brake is released, for example in the case of the ROBA®-servostop® brakes, the coil capacity and thus also the energy consumption drops to just one ninth. The battery consequently runs longer and does not need to be charged as often. In addition, this keeps the temperatures in the frequently limited installation space low, which is beneficial to the service life and the required insulation class of the entire system.

mayr®
your reliable partner

Headquarters

Chr. Mayr GmbH + Co. KG
Eichenstraße 1
D-87665 Mauerstetten
Tel.: +49 83 41/8 04-0
Fax: +49 83 41/80 44 21
public.mayr@mayr.com
www.mayr.com

Service Germany/Austria

Baden-Württemberg
Esslinger Straße 7
70771 Leinfelden-Echterdingen
Tel.: 07 11/78 26 26 40
Fax: 07 11/78 26 26 39

Bayern
Industriestraße 51
82194 Gröbenzell
Tel.: 0 81 42/50 19 808

Franken
Unterer Markt 9
91217 Hersbruck
Tel.: 0 91 51/81 48 64
Fax: 0 91 51/81 62 45

Chemnitz
Bornaer Straße 205
09114 Chemnitz
Tel.: 03 71/4 74 18 96
Fax: 03 71/4 74 18 95

Kamen
Herbert-Wehner-Straße 2
59174 Kamen
Tel.: 0 23 07/24 26 79
Fax: 0 23 07/24 26 74

Nord
Schiefer Brink 8
32699 Extertal
Tel.: 0 57 54/9 20 77
Fax: 0 57 54/9 20 78

Rhein-Main
Kohlhäuser Str. 3-5
36043 Fulda
Tel.: 06 61/96 21 02 15

Österreich
Pummerinplatz 1, TIZ I, A27
4490 St. Florian, Österreich
Tel.: 0 72 24/2 20 81-12
Fax: 0 72 24/2 20 81 89

Branch office

China
Mayr Zhangjiagang
Power Transmission Co., Ltd.
Fuxin Road No.1298, Yangshe Town
215637 Zhangjiagang
Tel.: 05 12/58 91-75 67
Fax: 05 12/58 91-75 66
info@mayr-ptc.cn

Frankreich
Mayr France S.A.S.
Z.A.L. du Minopole
Rue Nungesser et Coli
62160 Bully-Les-Mines
Tel.: 03.21.72.91.91
Fax: 03.21.29.71.77
contact@mayr.fr

Italien
Mayr Italia S.r.l.
Viale Veneto, 3
35020 Saonara (PD)
Tel.: 049/879 10 20
Fax: 049/879 10 22
info@mayr-italia.it

Großbritannien
Mayr Transmissions Ltd.
Valley Road, Business Park
Keighley, BD21 4LZ
West Yorkshire
Tel.: 0 15 35/66 39 00
Fax: 0 15 35/66 32 61
sales@mayr.co.uk

Schweiz
Mayr Kupplungen AG
Tobeläckerstraße 11
8212 Neuhausen am Rheinfall
Tel.: 0 52/6 74 08 70
Fax: 0 52/6 74 08 75
info@mayr.ch

USA
Mayr Corporation
10 Industrial Avenue
Mahwah
NJ 07430
Tel.: 2 01/4 45-72 10
Fax: 2 01/4 45-80 19
info@mayrcorp.com

Japan
Mayr Japan LLC
2F, 1-1-9 Nihonbashi Kakigara-cho,
Chuo-ku Tokyo, 103-0014 Japan
Tel.: 03/35 27-29 00
Fax: 03/35 27-26 61
public.mayr@mayr.co.jp

Singapur
Mayr Transmission (S) PTE Ltd.
No. 8 Boon Lay Way Unit 03-06,
TradeHub 21
Singapore 609964
Tel.: 00 65/65 60 12 30
Fax: 00 65/65 60 10 00
info@mayr.com.sg

Indien
Mayr Power Transmissions India Private Ltd.
Office No. 101A, First Floor
Delta-1, Giga Space IT Park,Viman Nagar
Pune 411014 Maharashtra, India
Tel.: 020/49 131 000
public.mayr@mayr.co.in
www.mayr.co.in

Representatives

Australien
Drive Systems Pty Ltd.
8/32 Melverton Drive
Hallam, Victoria 3803
Australien
Tel.: 0 3/97 96 48 00
info@drivesystems.com.au

Niederlande
Groneman BV
Amarilstraat 11
7554 TV Hengelo OV
Tel.: 074/2 55 11 40
Fax: 074/2 55 11 09
info@groneman.nl

Polen
Wamex Sp. z o.o.
ul. Pozaryskiego 28
04-703 Warszawa
Tel.: 0 22/6 15 90 80
Fax: 0 22/8 15 61 80
wamex@wamex.com.pl

Taiwan
German Tech
Component Co., Ltd.
No.10-3, Ln. 358, Sec. 1,
Hemu Rd., Shengang Dist.,
429012 Taichung City
Tel.: +886 (4) 25150566
Fax: +886 (4) 25152413
abby@zfgta.com.tw

Türkei
Representative Office Türkei
Kucukbakkalkoy Mah.
Brandium Residence R2
Blok D:254
34750 Atasehir - Istanbul, Türkei
Tel.: 02 16/2 32 20 44
Fax: 02 16/5 04 41 72
info@mayr.com.tr

Südkorea
Mayr Korea Co. Ltd.
15, Yeondeok-ro 9beon-gil
Seongsan-gu
51571 Changwon-si
Gyeongsangnam-do. Korea
Tel.: 0 55/2 62-40 24
Fax: 0 55/2 62-40 25
info@mayrkorea.com

More representatives:

Belgium, Brazil, Canada, Colombia, Croatia, Denmark, Finland, Greece, Hongkong, Hungary, Indonesia, Israel, Luxembourg, Malaysia, Mexico,New Zealand, Norway, Philippines, Portugal, Romania, Russia, Slovakia, Slovenia, South Africa, Spain, Sweden, Thailand

You can find the complete contact details for the representative responsible for your area in the Contact section at www.mayr.com

21/03/2024 GC

mayr.karriere mayrantriebstechnik mayrantriebstechnik mayrantriebstechnik