

PROSPECTIVE

Use of EFI* motors in recreational vehicles

BRP-Rotax, a company belonging to the Canadian corporation Bombardier Recreational Products Inc., is at the leading edge of the world market for the development and construction of 2- and 4-stroke engines. These power units are planned for use in recreational products, i.e. vehicles such as snowmobiles (Ski-Doo® and Lynx®), all-terrain vehicles (ATV), jet skis (Sea-Doo®), motorcycles and go-karts, as well as light and microlight aircrafts.



Gerhard STEINER
BRP - Rotax GmbH & Co
Development
Thermodynamics

Long years of experience combined with an excellent reputation for performance and quality have established BRP-Rotax as one of the best-known and most experienced engine manufacturers outside the automotive industry.

Following the trend in the automotive industry, such recreational products are increasingly subject to restrictions on exhaust gas emissions. Over the last decade, in order to ensure that its engines meet present and future emissions limits, BRP-Rotax has been stepping up development oriented towards fuel-injection. The use of electronic controls is a response to the requirements of customers, technical innovations and the increasingly stringent regulations for the protection of the environment.

The invention of the snowmobiles by the company's founder, J.A. Bombardier, in Canada, goes back to 1937. At that time, they were used mainly as transport and/or working vehicles. Even today, there is still a clear distinction between utility snowmobiles and sports and leisure vehicles.

The seventies were the period of the major development of jet skis and other PWCs (Personal Watercraft) for recreational use.

The most recent category of vehicles includes ATVs (All Terrain Vehicles) and quad vehicles (4-wheelers). Here again, a distinction must be made between utility recreational vehicles.

In recent years, the Rotax range of engines, consisting almost entirely of 2-stroke models with carburetors, has given way to a range of fuel-injection models, both 2-stroke (2-TEC) and 4-stroke (4-TEC).

This engine range concept is used systematically in BRP's different product categories.

The air flow in EFI engines is regulated by a butterfly throttle valve equipped with a position sensor and an idling speed governor. This regulation, which is decisive for reaction of the engine, enhances the driveability of the vehicle.

Due to a linear actuator (based on a stepping motor), the intake air circulates through a by-pass valve when the butterfly throttle valve is closed. This regulation system makes a stable idling speed possible, without any intervention by the driver, irrespective of air temperature and atmospheric pressure.

It should also be pointed out that, in the absence of a governor, the engine idling speed would steadily diminish with increasing altitude. Use of the linear actuator therefore enables the idling speed to be kept constant at any altitude from sea level to about 2,500 meters. For the BRP-Rotax company, as developers of high-performance engines, it is vital to have a reliable partner capable of providing comprehensive solutions for a complex range of engines. Consequently, the Sonceboz linear actuator has to be provided with flawless quality, performance and reliability, not only in for marine applications, but also in the dusty environment of all-terrain vehicles, enduring extremes of temperature and ever-increasing levels of vibration.

* Electronic Fuel Injection



Precise proportional movement in tune with safety and environment!

In a world where technological progress is advancing fast, our company is increasingly aware of its ecological and safety aspects.

Thus, new and increasingly restrictive regulations on pollution and energy-saving are issued regularly, aimed at improving our environment.

Certain applications requiring the use of proportional valves demand precise regulation of flowrates to achieve an optimum balance between performance and consumption.

In parallel, technical innovations serve to improve safety, for example in the automotive sector, where increasingly profuse functions like dynamic headlights adjustment are emerging. These movements direct the headlight beam in relation to bends in the road, in order to improve visibility and driver safety.

Christophe Habegger
Actuators R&D



Linear actuators

Multiplication of a mature product

The tin can linear actuator has been a SONCEBOZ specialty for many years. The reliability and performance of this technology, and the experience gained in a wide range of extreme working conditions, are long since proven. Let us mention, in particular, the automotive "under-bonnet" field, including, among other applications, regulation of engine idling speed and optimization of gas flow for vehicles running on LPG or methane.

Furthermore, in view of the fact that this market demands quality and reliability with failure rates close to zero parts per million, it is justifiable to envisage employment of the linear actuator in a wide range of applications. Building on this solid foundation, SONCEBOZ offers a diversification and multiplicity of products in which every customer will be able to find an appropriate, per-

sonalized solution to perform the required movement. Adherence to this principle made possible an innovative concept that takes into account the compact dimensions of the new generation of dynamic headlights. This enables an optimised integration of an actuator into the reflector of our customer's xenon gas discharge head light. The SONCEBOZ movement,

incorporating a magnetic sensor, is able to direct the light beam on bends in relation to different parameters such as steering angle and vehicle speed. In this way, the linear actuator enables flawless operation in a hostile environment, thus contributing to better visibility under all conditions and therefore significantly improved safety.



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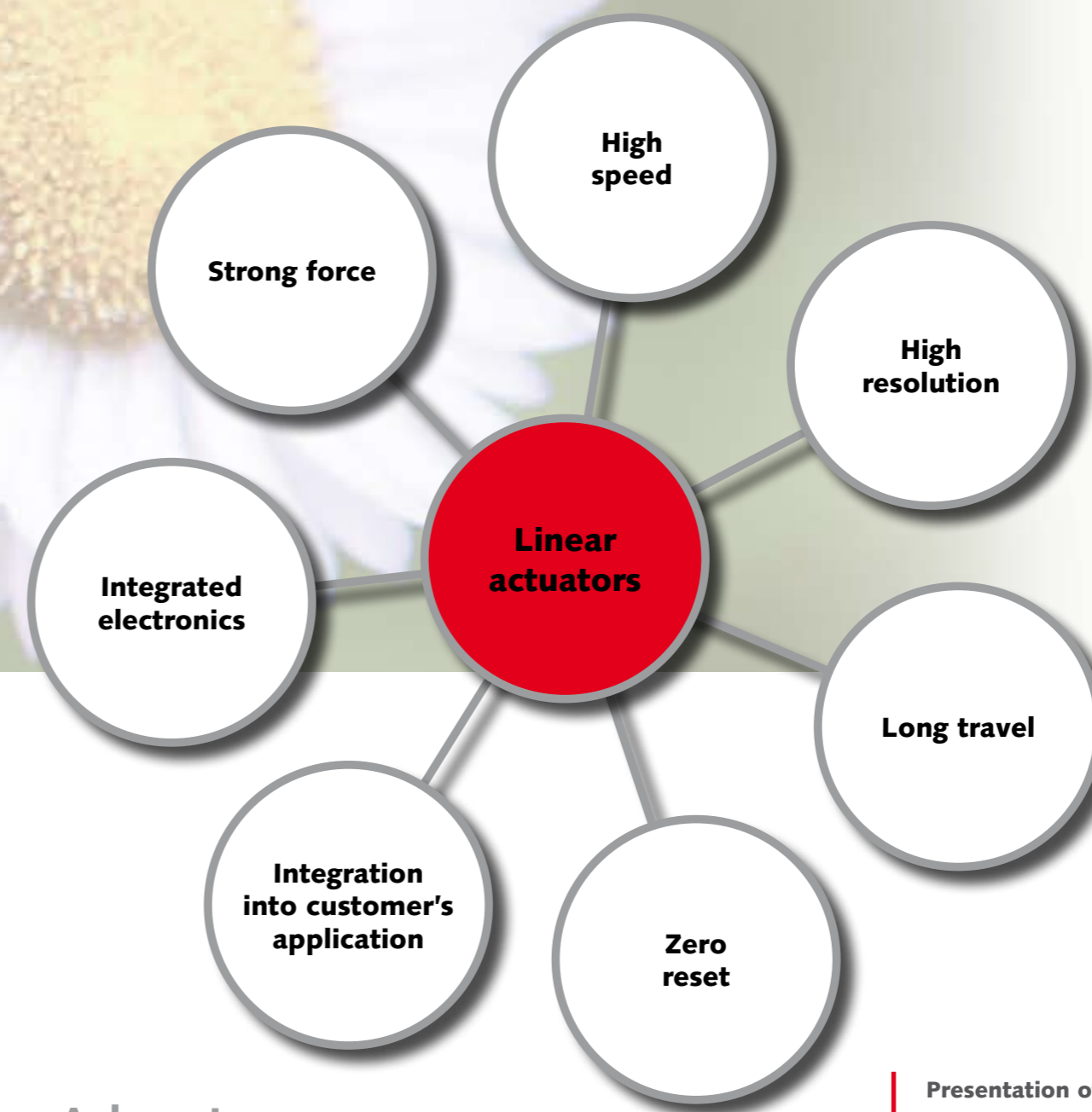
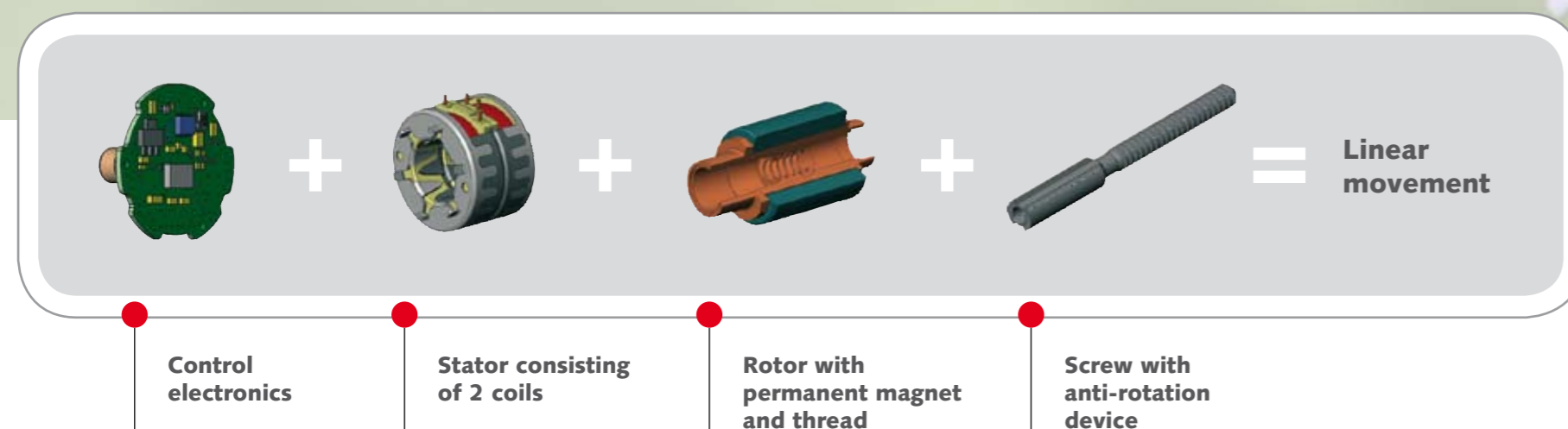


Feature

Smart linear movements

Linear stepper actuators are digitally controlled. An "incremental" magnetic field, generated by applying current alternately to each coil, causes the rotor to turn. This drives the screw linearly by the combined action of the thread and the anti-rotation mechanism. The movement thus obtained is a forward "step by step" linear incremental feed, the position and speed of which are controlled without the need for a position sensor. The linear speed is a

function of the control frequency, expressed in steps per second, and of the pitch of the screw/nut element. In the same way, the position signal transmits the number of steps or micro-steps (an "electronic" subdivision of a full step) which the rotor performs, thus transforming the rotary movement into a linear movement in relation to the pitch of the screw. Linear actuators therefore constitute a simple, reliable and economical solution for numerous applications.



Regulation of gas flow for a condensation boiler



Optimization of air flow for constant engine idling speed



Precise fertilizer spraying



Enhanced safety due to directional headlights



Integrated control electronics and regulation of gas flow

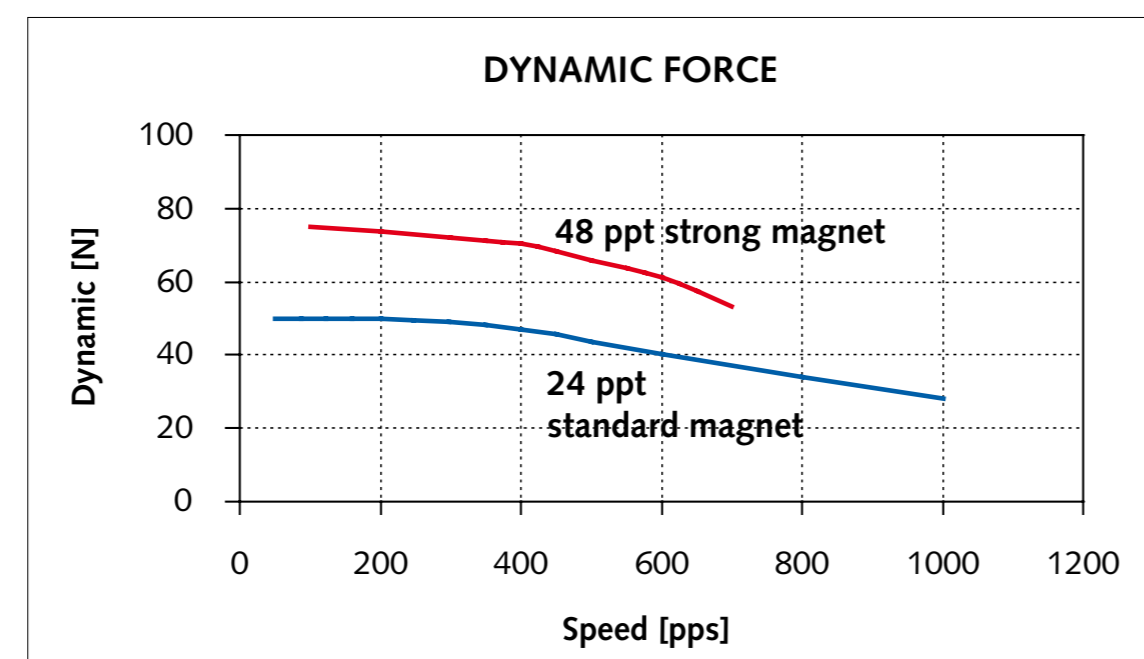
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Another example comes from a spraying specialist: the same basic actuator, supplemented with a box incorporating a screw-thread for easier interchangeability and finer resolution, enables precise, ecological regulation of liquid fertilizers and pesticides. In this way, this intelligent metering contributes to reducing the quantities of liquid needed and therefore helps in improving our environment through more efficient spraying.

These examples clearly show how a reliable, sturdy, tried and tested basic device can be extended with elements such as sensors, extended travel or suitable electronic boxes for optimized integration. SONCEBOZ offers a range of standard products, but is able to meet the needs of the customer and this application by incorporating innovative ideas and special adaptations.

By integrating control electronics and/or a sensor in the actuator, it becomes possible to create smart systems capable of communicating by BUS (LIN, CAN) or PWM, or of providing information on the position of the system.

Performances



* Bipolar, chopper 24V, i = 200mA, room temperature - Step/rotation: ppg- Step/second: pps

Advantages

- Compact dimensions
- Incremental movement
- Open-loop control
- Precise positioning
- Reliability
- Cost
- Works in hostile environments

Characteristics

- Temperature: -40 ... +120°C
- Vibration: max. 40g
- Resolution: 0.017 ... 0.16 mm
- Speed: 0 - 50 mm/s
- Stator diameter: 25.4 mm
- R/L or chopper drive
- Rated current: 200 mA
- Voltage: 12 ... 24 VDC