

ROBOTERWERK



Application Solutions Case Study

Forbot: Radio-controlled Robot

Featured Product – **Hornet 5/60**

High power density in all-weather and
all-terrain applications



Elmo
Motion Control
www.elmomc.com

The Requirement: Compact Size & High Power Under Extreme Conditions

The challenge:
Highly reliable drives that provide accurate motion control to a remotely controlled robot

Elmo's **Hornet** servo drives are intelligent, high power and compact. This case study shows how Roboterwerk GmbH, a manufacturer of rugged, outdoor, unmanned vehicles, used them for the Forbot – a portable, all-terrain robot. This paper will interest you if you would like to:

- Get up to 3.3 kW of peak power using a matchbox sized servo drive.
- Have superior motion control even in remotely controlled devices.
- Use products that can withstand extreme conditions and are compliant with military standards.
- Minimize your development time, resulting in short time-to-market.

Machine Description

The robot is radio-controlled, highly adaptable and made from aircraft-grade aluminum. All elements of the design have been ruggedized in order to enable it to operate in a wide range of environmental conditions.

The robot boasts six wheel drive and consists of a lower shell, which houses the electronics, and a flatbed platform that can be customized for a wide range of client applications in the military, civilian and scientific research areas. The platform can either be tailor-made so that the application is seamless with the wireless robot, or the user can customize it.

The wheels are fitted with rubber chevron tires that provide high traction and agility, similar to that of a tracked vehicle, while enabling speeds that are expected of a wheeled vehicle. The wheels are extra-wide at 85 mm and the tires have a 5 mm tread depth – both of these features contribute to the overall stability and robustness of the vehicle.

The internal housing for the electronics is waterproof while the external finishings are splashproof. The robot can function in cold, snowy conditions as well as desert temperatures.

The Forbot is portable and has the following dimensions:

Length: 60 cm Width: 50 cm Height: 20 cm.

It has a retractable handle and a net weight of 20 kg. Most customer enhancements placed on the platform are expected to be lightweight, but the sturdy robot can handle payloads of up to 30 kg, for a gross weight of up to 50 kg.

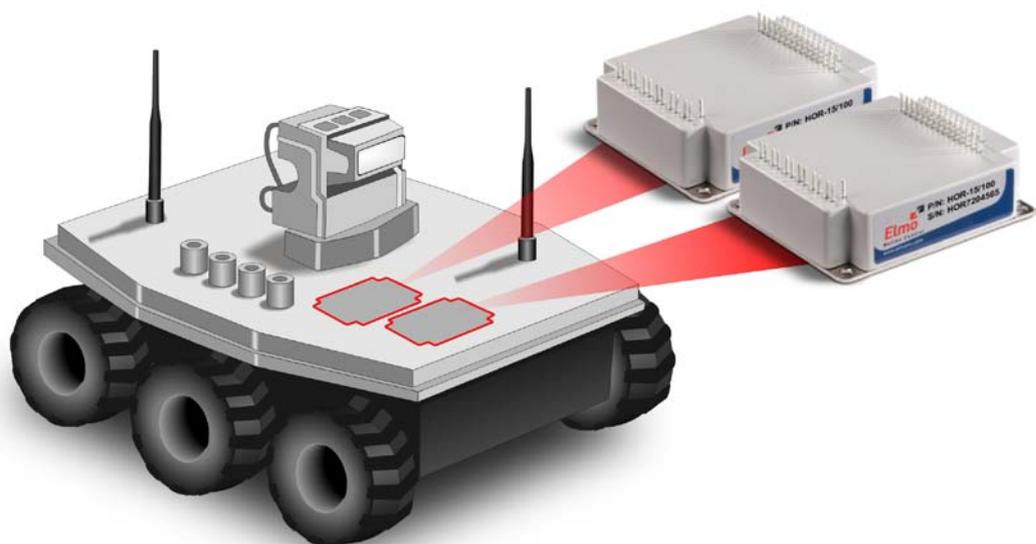
The Forbot is radio controlled and an iPhone app has been developed to send commands in Elmo's programming language directly to the controller. Using Apple's touch screen technology, navigation is incredibly simple.

Application Challenges

Roboterwerk's main aims for the multi-application robot were:

The unmanned vehicle must perform reliably under extreme environmental conditions

- The ability to operate in extreme environmental conditions and all terrains. The highest quality materials were used (aircraft-grade-aluminum, six-screw wheels, stable foam rubber, etc.) and all electronics components are from leading suppliers that have a reputation for quality and reliability.
- **Portability:** In order to meet the stability and robustness requirements, the robot needs a certain minimum weight. However, it is still required to be portable.
- **High power:** At 60 cm x 50 cm the Forbot is not a miniature robot, and so requires high power output to maneuver and reach the speeds required for military operations.
- **Agility:** The vehicle turns on its own wheelbase and can negotiate tough terrain. This requires superior motion control to enable swift and smooth operation in unpredictable conditions.
- **Reliability:** The remotely controlled robot is expensive and the customer payload is often mission critical when used for scientific experimentation and military operations. High reliability under challenging conditions is a given.



Elmo's Solution

Note: In some cases, Elmo's Falcon servo drive can be used for extreme conditions. For industrial applications Elmo's Whistle servo drive may be used instead.

A matchbox sized, PCB mountable drive that can provide up to 3.3 kW of power

Two **Hornet** digital servo drives were chosen for this application, due to their compact size and light weight. They are PCB-mounted and as such have the ability to be integrated into the robot.

The **Hornet** is very compact, measuring just 55 x 15 x 46.5 mm and weighing only 50 g. It has a peak output of 3.3 kW – 30 A at 100 V.



Hornet Intelligent Digital Servo Drive

The **Hornet** is a member of Elmo's ExtriQ Line, designed especially for rugged and EEC conditions. This allows the Hornet to operate in the following extended conditions:

- Ambient temperature: -40 °C to +70 °C
- Temperature shock: -40 °C to +70 °C within three minutes
- Mechanical shock: ±20g; Half sine, 11 msec
- Upwards of 90% relative humidity
- Vibration – up to 2 kHz
- Altitude: -400 m to 155,000 m
- Reduced EMI and minimal RFI

The **Hornet's** light weight made it an ideal choice for the Forbot and its high power enables optimal performance even when it has a full 30 kg payload for an overall weight of 50 kg.

Elmo supplies detailed documentation and consulting services for product integration on the PCB. This enables the best possible fit for the application.

High reliability for both military applications and scientific missions

The **Hornet** drives already include the capability to perform sophisticated motion control loops for precise movement, feedback inputs, programming capabilities and communication support. Its excellent connectivity reduces time to market and eliminates the need for extra components.

Elmo's proprietary Elmo Studio software is used to program the commands for the **Hornet** and this enables the robot to perform the precise tasks that require rapid and accurate movement.

Why Elmo

- Compact, pin-based, PCB-mounted products that have a small footprint.
- High power density and intelligence within a small package.
- Ready for the extreme: the ExtrlQ Line meets the extreme demands of battlefield applications.
- Dedication of support engineers to the successful implementation of solutions.
- Fast, precise and smooth motion control.
- High reliability in demanding military and scientific environments.
- Standard communication protocols.

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