



Application Solutions Case Study

High Mobility Robot

Featured Product – **Whistle 20/100**
Integrated Solution for a High Powered
Mobile Robot



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Elmo
Motion Control
www.elmomc.com

The Requirement: Compact, High Power Motion Control with CANopen Communication

*The challenge:
Reliable, high
power drives in a
confined space for
a mobile robot*

Elmo's **Whistle** digital servo drives are compact, with high power density. This case study shows how one of our customers in the robotics industry, Autonomous Solutions Inc., used them to increase the power and agility of their Chaos mobile robot platform. This case study will interest you if you are considering the following in your application:

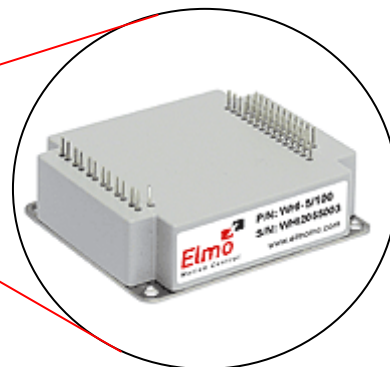
- Implementing up to 1.6 kW of continuous power using a matchbox sized servo drive.
- Maximizing your motor torque output with high current capability in a small form factor.
- Minimizing the weight of a mobile platform.

Machine Description

The Chaos mobile robot from Autonomous Solutions is an autonomous tracked robotic platform designed for high mobility in areas with challenging terrain. It can carry a wide range of sensors and payloads.

The high mobility is a result of four tracked arms that provide both high speed and strength. A real-time distributed control system controls each tracked arm independently, allowing agility and versatility in steep, uneven, and loose terrain.

The Chaos robot's four tracked arms use two motors: (1) for rotating the arm and (2) for track locomotion. The arm's rotation allows the robot to change its posture, climb over obstacles, elevate its body, etc. and the tracks provide the locomotion and steering. The Whistle's high power output provides high arm torque and rapid changes of arm position to allow high agility under heavy loads. While moving across terrain the Whistle's high power allows the robot to move at speed both on flat terrain and steep inclines.



Each track has two Whistles

The robot is controlled via CANopen in a distributed control system. The DS-402 protocol is used for motion control in addition to Elmo's DS-301 binary interpreter. This allows the Whistle's proprietary command set to be used to enhance the motion control modes via the DS-402 protocol.

The mobile robot must be fast, strong and agile.

Application Challenges

Autonomous Solutions' main aims for the Chaos mobile robot were:

- Increase the speed and strength of the platform for traversing terrain, carrying high payloads, and climbing over obstacles.
- Maintain the existing control architecture and communication protocol.
- Minimize the footprint of the design to reduce the weight and size of the enclosure where the drive sits.



Elmo's Solution

A matchbox sized, drive that can provide up to 1.6 kW at 80 VDC

The **Whistle** digital drive was chosen for this application due to its extreme power density and CANopen compatibility.

The **Whistle** is very compact, measuring just 55 x 46.5 x 15 mm (2.2" x 0.6" x 1.8") and weighing only 50 g (1.8 oz). It has an output of 1.6 kW – 20 A at 80 VDC.



Whistle Intelligent Digital Servo Drive

Eight **WHI-20/100s** were chosen to be installed in the robot.

The **Whistle** is a member of Elmo's SimplIQ product family, designed especially for applications where compact size, high power density, and robustly implemented standard communication protocols matter the most.

- An industry leading combination of power output (>1.6 kW) and compact size (55 x 46.5 x 15 mm).
- Robust implementation of the CANopen protocol, adhering to the standard communication and motion control protocols while allowing extensions due to the rich command set.

The **Whistles** are installed at the juncture between the tracked arms and the robot body. Each tracked arm uses two **Whistles** which are both mounted on a PCB designed by the customer.

The **Whistle** drives provide closed loop motion control, feedback inputs, and communication support. Compliance with CANopen, the DS-301 communication protocol and the DS-402 motion device protocol allow the customer's pre-existing robot controller to provide high level motion commands to the **Whistle**. Additional, manufacturer specific CANopen implementations also allow for control and monitoring above and beyond what the standard protocols provide, without affecting compliance to standards.

Our experienced engineers will help you get it right the first time, on site.



Why Elmo

- Compact and lightweight drive with high power density to provide superior power for a mobile robot.
- Compliance with standard communication protocols allows the customer to re-use their existing control platform.
- Dedication of support engineers to the successful implementation of solutions on site.

The Whistle is the only digital servo drive on the market that can handle both the extreme power requirements and the tight spaces of the high-performance Chaos robot. It allowed us to take full advantage of the design, giving Chaos a carrying capacity of well over 45 kg (100 lbs) and a top speed that rivals any robot in its class, a significant improvement over the previous implementation. Product support was also excellent, with responses from Elmo's engineers taking hours instead of days.

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