

Feeding cows in the 21st century

Livestock must be fed multiple times a day, 365 day a year. Mixer-feeders can support this process. They are designed for farms with a large number of animals. Sgariboldi (Italy) chose Epec (Finland) units for its added Titanium series.

Figure 1: The self-propelled mixer-feeders (Source: Tritecnica)



Heading south from Milan, the landscape shows farms, fields, and industries. In this setting Sgariboldi, one of the main mixer-feeders builders in Italy, placed its headquarters; from here its machines, always equipped with cutting-edge technology, are exported all over the world. Mixer-feeder operation, in principle, is very simple: the various ingredients for cows food are cut, optionally milled, and loaded by the front boom, then mixed in the rear tank and the mix is finally unloaded. Sgariboldi machines provide: loading capacity, processing speed without compromising on mixing quality, and economy. These benefits are obtained with patented algorithms that enhance the overall operation of the machine, relieving the operator from stressful duties at the same time: automatic selection of the best cutting speeds and milling for each ingredient (Intelliloader machine), advanced mixing strategies (Intellimixer machine), optimum distribution of the food (if coupled with an optional, intelligent transmission), active suspension control for maximum traction on every ground, no matter how uneven it is.

Self-propelled mixer-feeders

Titanium is a new generation of vertical self-propelled mixers of big volume, designed for all farmers who need to manage mixes with a high specific weight, with a machine that also offers loading performance and great maneuverability. A series of ultra-light machines because they are built with special alloys that allow enormous loads to be handled with only two axles, and combine the typical efficiency and durability of Sgariboldi mixers. Also designed to optimize loading times, it features the largest loading drum on the market: 2 200 mm width and 210 horse power. Combined with a loading arm 35 % wider, this makes the series unique in

its kind. The series is based on Epec's CAN-featured products.

The backbone of Sgariboldi machines consists of two CAN high-speed networks. The first one, running J1939, connects the electronically managed engine, a Topcon display, an Elobau Multifunctional Armrest – to safely (programmable logic controller) interface human driver and machine - and the Epec EC44 compact control unit, to control engine speed.

The second network uses the CANopen protocol as the vehicle backbone: the Epec EC44 control unit (commander) processes all the logic programmed with Codesys 3.5, extended by an Epec GL84 (responder) for the acquisition of all inputs, pressure, temperature, frequency and level sensors, and control of proportional valves. On the same network the display, CAN sensors for oil quality measurement, electronic suspension management and weighing system are also integrated, allowing a seamless interaction between all the elements of the machine.

The brain of the machine is the already-mentioned Epec EC44 control unit: due to its processor and Codesys 3.5, it is possible to implement complex control algorithms with ease and no fear of overloading. This is enabled even with a cycle time in the single-digit millisecond range, moving the boom and controlling the speed of all the



Figure 2: The EC44 has a 32-bit processor and large internal memory for application and parameters. It has 16 inputs and 16 outputs with high-side current measurement, two CAN networks, and a status LED. (Source: Epec)



Figure 3: The GL84 is for centralized control system architecture where one commander/central unit controls multiple responders. It has a whopping 27 GND pins for sensors and actuators and CAN1 is also routed to M12 connectors for wiring. (Source: Epec)

hydraulic actuators with precision. Its 16 inputs and 16 current-controlled outputs, each with extensive diagnostics, are packed in an IP69 aluminum case, that makes the machine builder able to place it with freedom, being confident that no vibration, shock, water, mud, dirt, or short-circuit will damage the unit. Top-notch CANopen support enables programming and responsive debugging directly on the vehicle backbone at 250 kbit/s, without feeling the need for an Ethernet port: sluggish performances of Code-sys online interface because

of CAN communication are a thing of the past. And service personnel can update the unit via the display by a simple USB key, thanks to CiA 302-3 compliant software and firmware update procedure. CiA 302-3 CANopen additional application layer functions - Part 3: Configuration and program download, defines objects and file formats for the configuration manager and for program download and control.

The introduced EC44 is complemented by an Epec GL84 (responder) CANopen unit, built on the same architecture of EC44, thus sporting the same performances which make the engineer feel I/Os are on the commander control unit instead of being remote. Most of its outputs can be set up as current-controlled with an advanced algorithm, removing the need to close the loop in the commander control unit. Its case is as robust as the EC44 one, to withstand any conceivable abuse.

EC44 also manages the engine via J1939, directly or via the electronic transmission, using the Epec custom J1939 stack (Codesys one is nonetheless available). Sgariboldi developed the new control concept, which includes a revamp of the whole cabin and HMI (human-machine interface), in close cooperation with the engineers of Tritecnica, Epec Italian partner since 15 years, which developed all the software as a turn-key project. Ponsse Group technology company Epec is a system supplier specializing in advanced electrics/electronics for efficient, safe, and connected non-road mobile machines (NRMM) and commercial vehicles. Epec is a manufacturing company with extensive experience in control systems, customized products, electric vehicle systems and assistance, and autonomous systems. Since 1978, Epec's diverse experience is based on long term cooperation with leading international OEM's (original equipment manufacturer) in different sectors.

"Although our collaboration with Epec is quite recent, we immediately appreciated the quality of their hardware: well-made, reliable, and high-performance products. We are sure that it will be a really good partner also in the future," said Luca Sgariboldi, President of Sgariboldi.

Tritecnica concluded: "We love to raise the bar of performance and Epec controllers are the perfect mix of reliability and technology, as well as Luca Sgariboldi who is a practical but technology enthusiast. For us it's a pleasure and a challenge to be the bond between these companies". ◀

CAN Newsletter Online

The CAN Newsletter Online as well as the magazine, already reported several times about CAN in agriculture and farming.



CAN Newsletter magazine **History and trends: CAN in agriculture and farming**

The world human population is growing. CAN was helping, is helping, and will be helping to provide people with food and beverage.

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Agriculture milestone **Fully autonomous tractor**

At CES 2022, John Deere revealed the 8R autonomous tractor that is ready for large-scale production. The company uses CAN-based Isobus network(s) for interconnection of ECUs (electronic control unit) inside the tractor and between the tractor and implement.

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Farm robotics **Milking control unit with CANopen**

The MDS Saccomatic IDC by SAC (Denmark) is a milking control unit that communicates via CANopen. It was designed to create an easier workplace for milkers.

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Service robots **Cows decide when it's milking time**

The Boumatic (Netherlands) milking robots are equipped with CAN providing sensors from Sick (Germany). With those milking robots, cows can decide for themselves when they want to be milked.

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Expansion card **CAN solution for agricultural implements**

Farm cultivators attached to tractors require two CAN channels to operate. Innodisk's EMUC-B202-W1 embedded CAN expansion board, provides a solution without redesigning the mainboard by facilitating CAN communication through a MiniPCIe interface.

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Agritechnica 2022 **Award for CAN-based products**

Development engineers from the agricultural technology sector have selected the three winners of the Systems & Components Trophy – Engineers' Choice. CAN is part of these products.

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