

Robust PLC for field applications

The Danish company Agrometer produces pump vehicles used for spreading liquids and substances on agricultural land. The units are controlled by a powerful mobile controller from ifm.

Agrometer was founded in Grindsted in 1977 and is a global supplier for business divisions such as agriculture, the public sector, industry and shipyards.

Many farmers use the slurry produced by their animals as a fertiliser for crop production. However, the average slurry vehicle with slurry tank is at best suitable for small fields.

The Danish company Agrometer headquartered in Grindsted develops solutions that allow quick, cost-effective and soil-friendly spreading of natural fertilisers even on large fields. A hose is used to transport the slurry from a central location to the fields. For this purpose, special vehicles are equipped with a huge hose reel. The electro-hydraulically powered reel unwinds and rewinds the hose as needed while driving across the field. When changing the direction, for example at the end of the field, a guide arm positions the hose in an even radius.





The umbilical injector SRS 1500 is pulled over the field by a tractor to spread slurry.

The performance is remarkable: Up to 200 tons of slurry can be spread per hour. The advantage: As no slurry tank is required on the vehicle, the vehicle weight is reduced. This reduces the soil pressure to a value lower than a footprint. The low self-weight means the farmers can enter their fields early in the year when the soil is still soft. The fertiliser is pumped directly to the machine via pipes and hoses, removing smell issues from the roads. Agrometer builds these slurry spreaders as independent vehicles with a spreading width of up to 30 metres or as trailers for tractors called umbilical injectors.

■ Central PLC for machine control

Both variants combined: The important functions, such as the coiling of the hose, are controlled automatically by a central PLC. A large number of sensors is used to monitor the movement of the hose guide arm and other positioning tasks, which are signalled to the controller via decentralised IO modules. Sensors also monitor the pressure in the slurry pipes or temperature values.

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The self-propelled slurry spreader SDS 8000 can spread up to 200 tons of slurry per hour via the hose.



Oluf Kristensen, Technical Manager at Agrometer, explains, “For our machines, we use the new mobile controllers as well as decentralised IO modules from ifm. They simplify the wiring and maintenance of the machines, which can be set up faster. When developing the machines, we primarily work with the system integrator Pagaard. They supplied us with the complete ifm system and developed the software. Pagaard is also our service partner for error-handling.”

The system integrator Pagaard relies on ifm’s “ecomat-Controller”, which is specifically designed for use in mobile machines.

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Robust decentralised I/O modules receive sensor signals and transmit them to the PLC via CAN bus.



ifm's ecomatController for mobile applications (bottom right) is mounted in the control cabinet outside the vehicle.

Pagaard's Managing Director and co-owner **Torben Lund** explains the decision to use ifm, “Initially, we were using an industrial PLC at Agrometer. But we soon realised that the durability of industrial products used on mobile machines is a huge challenge, as they are not designed for such purposes. So we scoured the market for technologies that could withstand the harsh requirements of mobile applications. We came across ifm where we had already bought sensors. ifm offers a controller we believe is best suited for this task.”

■ Designed for extreme operating conditions

For many decades, ifm has been one of the leading suppliers of robust control systems for mobile use, offering extensive application know-how in this field. The “ecomat” series comprises PLCs, IO modules and sensors that can withstand the harsh environmental influences of mobile applications.

Slurry, water, permanent condensation or dirt are no problem for the ifm systems for mobile applications. The special mechanical design of the housing and a reliable sealing concept prevent the penetration of moisture. Suitable connectors and connection cables ensure that protection rating IP 69K does not end at the housing connections.

Extreme weather conditions with iciness or blazing heat: The wide temperature range of the control components from ifm allows use in all climatic zones. All sensors and controllers must prove their resistance in cyclical temperature shock tests. Resistant housing materials ensure that salt deposits, as they may be caused by grit in winter, do not affect the products.

Where the going gets tough, the material is exposed to permanent vibrations or extreme impact. This is why the sensors for mobile applications are fully potted. Connectors are protected against unintended loosening by a special vibration protection. The mechanical design of controllers and modules is especially rated for permanent shock and vibration.

The complex electronics is protected against electromagnetic interference as detailed EMC tests have shown. Conducted interference is reliably filtered out and cannot affect the controllers. This ensures that the data exchange via the CAN interfaces functions reliably even under most adverse conditions such as in outdoor applications of transport and logistics.

Pagaard Software Engineer **Michael Lindbjerg** explains, “The voltage of a mobile machine fluctuates strongly. An industrial PLC is not designed for this. A PLC for mobile applications is better suited as it operates with a wide voltage range between 8 and 32 volts.”



The yellow guide arm places the supply hose of up to several hundred metres in length on the field in the form of curves, ensuring that the hose is coiled correctly on the drum.

In addition, all ecomat components have an e1 type approval by the German Federal Motor Transport Authority. This allows installation of the units on vehicles without invalidating their operating permit. Beyond the required EMC limit value of the e1 type approval all units have an extended EMC resistance of 100 V/m and withstand pulses from the on-board vehicle supply system without problems.

■ Powerful controller

The ecomatController CR721S used at Agrometer consists of two internal PLC units, one of them certified for safety-related applications up to EN 13849 PL d and EN 62061 SIL cl2. The advantage of this double PLC: Two internal, independently programmable controllers allow for subdivision of the application software if required. Consequently, the safe program part can be executed without interference from the general program execution. Powerful 32-bit multi-core processors ensure fast program execution even with complex control tasks.

The ecomatController CR721S features 68 multifunctional inputs and outputs.

Pagaard Software Engineer **Michael Lindbjerg** explains the benefits, "All inputs can be configured as digital, analogue or frequency inputs. We used to have problems with the monitoring of our outputs, which

were purely digital in the industry, but the ifm controllers have PWM outputs. This is an important feature in the mobile world, for example for controlling hydraulic valves with pulse-width modulated outputs."

In mobile machines and equipment most functions are carried out by hydraulic systems. Electronic valve and pump control has become a standard in modern machines. ifm's ecomatmobile system provides current-controlled PWM outputs and optimised control functions for the power outputs. This leads to a manufacturer-independent interface between hydraulics and electronics.

■ Conclusion

The mobile controllers from ifm ensure ultimate reliability and a powerful performance even in challenging operating conditions. Thanks to their versatile connectivity and functions, they offer maximum flexibility. With this robust PLC, ifm guarantees the quality that is indispensable for harsh mobile applications. ifm – close to you!