The GRi-P1 Gritzke automatic leveling system for graders increases the flexibility and productivity of the machines significantly. This helps save material costs for earthmoving and fine grading. The system can be equipped with several sensors and it combines easy handling with a self-explanatory user interface. Each millimeter counts when miles of road sections under construction need to be graded to the same level. A grading that is only one millimeter higher than required can easily cause several truckloads of additional material.

Laser leveling

Leveling long stretches with millimeter precision is only possible by applying efficient modern technology. Here, laser-based systems have proven to be particularly accurate, cost-efficient, and reliable. Function principle: A laser fixed to a tripod rotates around its own axis to create a laser level. This level can be adjusted in parallel to the required surface. A vertical photoelectric receptor cell mounted to the grader blade receives the laser beam.

An intelligent controller tracks the laser receptor and the grader blade to make sure they are always at the exact height with the laser projection level. This way, the driver can focus on the horizontal movements of the grader blade.
CANopen extension
for SIMATIC® S7-1200

Also available: 1 SI CANopen
CANopen module with CAN 2.0A support for SIMATIC ET200S decentralized peripheral systems

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grader while the blade is automatically kept at reference height with millimeter precision. To level sloped surfaces, the laser can simply be adjusted in parallel to the required slope. Depending on whether the grader movements are longitudinal, transverse, or diagonal to the slope, different lateral blade inclinations are required. With laser-based systems, the blade inclination can be controlled automatically. For this purpose, a second laser receiver is installed on one side of the grader blade. Alternatively, an inclination sensor and/or an ultrasonic sensor is used on the blade.

Gritzke Lasertechnik OHG is based in Lemgo, Eastern Westphalia. It is specialized in the development, production, and distribution of construction machine control and positioning systems. One of its central credos is: Circumvent the product monopoly constraints of the market leaders. For this reason, the systems can be installed on any machine, even if it is already pre-equipped with cables.

To distinguish themselves from common systems, Gritzke has considered the advantages and disadvantages of all systems while putting their own ideas into practice.

A new flexible system

In the past, Gritzke used programmed controllers from different manufacturers to control the leveling systems. A disadvantage was that the company could not carry out customer and machine-specific adjustments or software modifications as the system integrator. The hardware manufacturers had the ownership of the software. Individual adjustments or modifications were very time-consuming.

Figure 3: Dennis Blume from ifm on site: The controller was tested on the machine and the programming adjusted again and again (Photo: ifm)

Figure 4: Gritzke developed and built the marketable system in cooperation with ifm Electronic (Photo: ifm)
Applications

and cost-intensive, or were refused.

Rolf Oschatz, managing director at Gritzke, explained: "About two years ago, I decided that we would develop our own laser-based leveling system for construction machines. The aim was to offer our customers a combination of special user-friendliness, high accuracy, and best-possible competitive price. With our development, we basically did not reinvent the wheel, but combined all advantages of the competitive systems with our ideas and requirements."

Application know-how is one thing, but when it came to the heart of the system, the controller and its software, Gritzke found their present partner, Ifm Electronic, more or less by accident. Rolf Oschatz added: "The development together with the earlier hardware suppliers was rather slow. The initially promised support was very hesitant and consisted of target figures rather than technical support. In April 2013, at Ifm Electronic's booth at Bauma, I was asked in an informative conversation if we needed help. Mutual interest arose quickly. What impressed me in particular: They did not ask about possible quantities but promised comprehensive project support." This was the beginning of the close partnership between Gritzke and Ifm Electronic. In cooperation with the automation specialist, Gritzke developed, built, and sold the first German CAN-based GRI-P1 leveling system for graders.

The following months were characterized by intensive co-operation. Dennis Blume, sales specialist for control technology at Ifm Electronic, had the lion's share in supporting the project. This was done in close cooperation with Gritzke because one important requirement on the new system was to have Gritzke's in-house software know-how. The heart of the installation is the CR0033 CAN-compatible Ifm controller for mobile applications. Ifm's CR1084 display with graphics capabilities is used as the operating unit.

Rolf Oschatz explained: "The cooperation with Ifm was passionate and successful. Often, we tested the software and hardware outdoors on the machines till late at night. Many thanks in this respect to the company Stork Tongruben und Transportunternehmen in Hiddenhausen who provided us with a caterpillar (Cat D6T) and the site, a clay pit, for thorough testing. And it paid off: after 18 months, we could implement the system until it was ready for the market. Without Mr. Blume's exceptional personal commitment, we would never have achieved this in such a short time."

Flexible in the application

The leveling system is the first of its kind to be developed, programmed, and built by only one supplier. The customer benefits from the fact that adaptations, special custom-
ed into a compact IP67 metal housing. Its monitoring and protective functions enable reliable operation even under extreme operating conditions. The high number of multifunctional inputs and outputs allows adjustment to the respective application using application software (IEC 61131-3 with Codesys). Depending on the type of input, a configuration as digital, frequency, or analog input with diagnostic function or as input for resistance measurement is possible.

The four CAN interfaces are in accordance with ISO 11898 and support various bus protocols and different bit-rates as well as transparent or preprocessed data exchange. The controllers were specially designed for robust applications in vehicles and for mobile automation and can carry out complex and proportional functions reliably.

Thanks to the closed die-cast aluminum housing with its protection rating IP67, the PDM360 NG dialog module can be used outside and inside the cabin – by means of surface or panel mounting. The scratch-resistant 7-inch TFT color display with a resolution of 800 pixels x 480 pixels and a color depth of 18 bits provides brilliant graphical representation. For operation, the module has nine backlit function keys with tactile feedback. In addition, an encoder with pushbutton or a navigation key is available depending on the model. The 32-bit controller is programmable with Codesys according to IEC 61131-3. In addition to the internal 1 GiB memory, the user can connect external media to the integrated USB 2.0 port.

Four CAN interfaces (ISO 11898) support CANopen, J1939, or a free protocol. Together with a 100 Mbit Ethernet interface and the Linux operating system, a universal platform for networking and communication with other vehicle components is formed. Connection is made via robust and safe M12 connections. The project benefits from the application know-how of many years, powerful hardware and, above all, the will to bring about something special together.

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