

Connection Technology Enables Automated Testing of Mounting Plates

Mounting plates are at the heart of the control systems in cold milling machines for road building. As a rule, they are supplied ready for installation. Previously, they first had to undergo laborious manual testing. The practical assignment completed by three state-certified technicians for their final examination puts an end to all that: their mobile test bed enables automated testing of all of the mounting plates' functions, thereby saving a great deal of time. "With a significant reduction in the testing time from around two hours to just about half an hour, our project has been an all-round success." In their practical assignment for their final examination to become state-certified technicians **Sabine Habeth, Daniel Gusowski and Serge Peters** developed and constructed a mobile test bed that automatically tests mounting plates measuring around 100 cm x 60 cm to ensure that they work correctly. Some background: The company **Planer Systemtechnik GmbH & Co. KG** in Troisdorf near Cologne produces around 500 of these mounting plates every year for **Wirtgen GmbH**, a well-known manufacturer of mobile plants. Some of them are used as the control center for cold milling machines as used in road building.

Up to now, testing these mounting plates has been a laborious task because the fitters had to manually test 654 contact points to make sure that they functioned properly and were correctly wired. "That job is now done by our testing machine. It performs a fully automatic wiring check and even carries out a sub-function test on the equipment," reports **Sabine Habeth**, who works in the technical sales department at Planer Systemtechnik.

A lot of work went into the development of the test bed with respect to both the design and the technical realization. The three technicians from class TE9W at the **Technical College for Electrical Engineering in Hennef** developed a special contact block that can adapt the numerous three-tier terminals quickly and simultaneously on

all levels. Consideration was also given to fast replacement of worn or defective individual blocks. With 378 spring pins each with 1 N spring force, the pressure force required for the whole contact strip adds up to 38.5 kg. This is generated

"... a mobile test bed that automatically tests mounting plates measuring around 100 cm x 60 cm to ensure that they work correctly"

by a straight line action clamp with a stroke of 80 mm.

Modular control with 64 bit per card

The electrical contacting or wiring of the 408 test circuits with a total of 938 wires was the next obstacle that had to

be overcome. **Siemens'** SIMATIC TOP Connect range was able to provide a solution here: There are input and output cards with up to 64 channels for the Simatic S7 300 CPU 315 2 DP controller installed in the test bed. Five such input cards and three output cards are sufficient to process all of the signals from the 408 test circuits.

The cards are arranged on the PLC, which results in a compact control unit. As **Sabine Habeth** confirms: "Due to the lack of space, we had to limit ourselves to just one rail for the control system, so the extremely compact solution from Siemens fitted the bill perfectly." What is more, the CPU is powerful enough to run through the test cycles quickly, and it has enough memory for the extensive testing program. To automate the testing process, a step sequence was realized in 762 networks and output or read in at 512 inputs and outputs.

The simple wiring connection of the numerous test contacts with the I/O modules is achieved via special terminal modules that can be plugged onto Siemens' pre-fabricated multi-wire cables via a plug-in connection. On the other side of the cables are the I/O modules which are slotted directly onto the DIN rail. The contact among all eight cards with each other and with the S7 controller is realized via a backplane bus with the aid of U-shaped adapter plugs. "It is a particularly elegant and compact solution when you have a vast number of channels as in this case," confirms **Sabine Habeth**.



Function modules are at the heart of the control systems in the cold milling machines from the manufacturer Wirtgen GmbH

Versatile visualization for high user-friendliness

A convenient solution to the complex task of automatically testing mounting plates for cold milling machines was found with the aid of Simatic TOP Connect. A lot more is now possible compared to the previous manual system test, which comprised only a simple continuity test. Thanks to the new method, typical testing errors such as incorrect reading of the wiring diagram and incorrect or forgotten testing procedures can now be avoided.

Visualization plays a key role in the overall concept. The controller communicates with the colored touch panel from Siemens via Profibus. The test bed is operated using nearly two dozen ready-made screens, which makes the job easier even for operators with no specific expertise in control systems.

The technicians chose the touch panel for its large internal memory, as over 600 diagnostic screens had to be programmed in addition to the operation screens. These clearly indicate faults during testing and give instructions on how to remedy them. Sabine Habeth recalls: "Even without previous detailed knowledge of how to program the WinCC flexible visualization software, we managed to get the job done without a great deal of difficulty."

Simple data archiving & documentation

If the controller reports a fault in the mounting plate during testing, the fitter receives all the required information from the corresponding diagnostic screen on the touch panel.

The fitter also sees what kind of fault occurred, which contacts are affected and how the fault can be remedied. For example, if it is a simple case of rewiring, the fitter loosens the two wrongly positioned contacts of the cage clamp terminal with a screwdriver and reconnects them. The display also indicates the correct tightening of a contactor, the functioning of a fuse or a break in the wiring.

The individual test logs are archived for the purpose of creating statistics. In this way, frequently recurring faults can



The SIMATIC TOP connect controller solution makes easy work of testing the 408 test circuits in the function modules

be specifically analyzed and prevented, thus increasing the efficiency and quality of mounting plate production. All this is made possible by the S7 TP177 touch panel from Siemens, which can be directly connected to the company's network via Industrial Ethernet.

The touch panel also has an integrated USB interface for connecting a printer.

"The controller communicates with the colored touch panel from Siemens via Profibus"

Following automatic testing, it is therefore possible to print a verification in the form of a detailed description of the tested work steps. This printed verification can be added to the documentation intended for the customer.

Coherent overall concept for a high degree of rationalization

After around one year of development time and several hundred working hours, the mobile test bed is now performing function tests on mounting plates in

Planer Systemtechnik's production department in Troisdorf. Thanks to the automated testing of a vast number of circuits, this medium-sized enterprise with its 50 or so employees has not only improved its production cycles but also its quality management.

This was achieved using Siemens' Simatic S7 300 CPU 315 2 DP controller in conjunction with special 64 bit input and output cards from the same manufacturer's SIMATIC TOP connect range. On the one hand, this allowed several hundred signals to be electrically recorded and evaluated and, on the other hand, the connection

technology with pre-fabricated cables enabled the connection of the tested contacts to the test cables with a reasonable workload.

The colored display on the panel, programmed with WinCC flexible programming software, rounds off the overall automation system in line with the principle of Totally Integrated Automation (TIA). This solution has proved to be enormously practical thanks to the integrated CPU with memory and the possibility of further processing and



outputting data via a network or USB port. As one may expect, the three technicians Sabine Habeth, Daniel Gusowski and Serge Peters are very pleased with the successful realization of their project: "Our test bed has brought about decisive improvements in practice, which means that at some time in the future we can think about other projects for other mounting plates." ■

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Sequence Forms Nationwide Automation Engineering Division

Sequence, Inc., a specialist in quality and compliance consulting for regulated industries, announced the creation of an automation engineering arm to support clients nationwide. Newly hired automation engineers and an existing Manufacturing Support team have joined forces to form an Engineering and Technical Services division within Sequence. Integration of these teams enables the company to provide end-to-end solutions to clients deploying new automation systems and to those enhancing existing systems. From functional requirements specifications to detailed design, validation and implementation, the Engineering and Technical Services group provides all deliverables needed to ensure successful process control and sound regulatory compliance. "It is with great pleasure that I announce the newest progression in the growth of Sequence," said *Mike Putnam*,



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President and CEO of Sequence, Inc. "This vision was developed by our management team over three years ago, and to see it solidified in 2015 with the official licensing of Sequence Engineering PLLC is very exciting. The ability to provide engineering services coupled with quality and compliance solutions is key to the future of our organization. Not only will it benefit our existing drug and device clients, but it also serves as a gateway into other regulated industries like energy and transportation." The

new division is off to a successful start in 2015 with multiple greenfield facility start-ups, global Serialization compliance initiatives and implementation of Process Intelligence programs for new and existing clients. With offices across the country and a global compliance center based near Research Triangle Park, NC, the company is poised to support quality, compliance and engineering services for projects ranging from large facility start-ups to individual system optimization initiatives. ■