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Applications

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HMI for Sun and Sand

Rugged, highly luminous touch panel facilitates comfortable operation and monitoring under the open desert sky

For the first time, several rows of illuminated pushbuttons in the control cabinet of a hydraulic power unit were replaced by a rugged, highly luminous touch panel for the on-site operation of a steam and gas cogeneration plant's diverter damper. The device's high luminosity and degree of protection also facilitate safe and comfortable operation and monitoring in desert applications – in glaring sunlight, at high temperatures and under permanent exposure to ultra-fine sand dust.

So-called diverter dampers are installed behind the gas turbines of gas and steam cogeneration plants for the controlled diversion of hot exhaust gases to the downstream heat recovery boiler or for their particularly rapid discharge to the atmosphere via the bypass stack in case of faults. As the damper blades may amount to 6.8 x 6.8 meters in size and 15 tons in weight, hydraulic power units (HPUs) the size of a garden shed with partially redundant automation are required to move them.



Hydraulic power unit (HPU) with daylight-readable MP377; The hydraulic power units (HPUs) by Pleiger Maschinenbau are responsible for the diverter damper's controlled opening and closing and for its emergency operation, e. g. in case of power failures.

The Dutch company NEM B.V. represents one of the world's major suppliers of heat recovery steam generators for gas turbine power plants. NEM is a globally leading engineering company in the field of steam generation for power plant and industrial applications. NEM's German subsidiary, NEM Power-Systems (NPS), develops its high-tech products such as diverter dampers in Recklinghausen, from where they are sold all around the world. Within the NEM group, NPS acts as the "center of competence" for all damper applications in fossil-fired power plants as well as for complete bypass systems upstream heat recovery boilers in gas and steam plants.

For years, NPS has had the respective hydraulic power units preferably manufactured by the Witten-based mechanical engineering company Pleiger Maschinenbau GmbH & Co. KG. In turn, this company favors the competency and services of its affiliate company Pleiger Elektronik GmbH & Co. KG when it comes to electrical engineering and automation technology (*see box for short profile*). In this context, "favors" does not imply that the group partner and neighbor is automatically awarded with the respective contract. In fact, it always has to stand up to technical and economic competition with external suppliers. This was also the case with one of the most recent projects carried out in the Middle East, within the scope of which the power plant planner for

the first time requested an operator panel with touch operation for the on-site operation of a diverter damper of a steam and gas cogeneration plant in the desert instead of the hitherto usual rows of various illuminated push-buttons.

Application under the open desert sky

As customary, also the new human-machine interface (HMI) was to be mounted in the control cabinet door of the HPU, which is installed directly at the gas turbine under the free desert sky. Consequentially, the operator panel is subjected to extremely bright sunlight, temperatures from $-10\text{ }^{\circ}\text{C}$ to over $+50\text{ }^{\circ}\text{C}$ as well as to the ubiquitous flour-like sand dust. Correspondingly, a display with very high luminosity, high contrast and high degree of protection was required, which is why the decision-makers opted for the daylight-readable SIMATIC Multi Panel MP377 15" Touch by Siemens. The panel offers an increased luminous intensity of up to $1,000\text{ cd/m}^2$ (dimmable from 0% to 100%) with a contrast ratio of up to 1,000:1 and therefore offers excellent readability also with direct solar radiation.

The panel features the following technology: The daylight-readable MP377 panel features a so-called transreflective display with LED background illumination. Transreflective displays, which are typical of navigation systems or GPS plotters in marine applications, are equipped with an additional reflective foil. This foil specifically utilizes the incident ambient light for an improved contrast and thus ensures the display's sound readability also in direct sunlight. The optical properties of this daylight-readable device are further enhanced by the fact that reflections are reduced to a minimum by a glass pane with projective-capacitive touch technology. Moreover, the increased temperature resistance of the device front allowed for its certification for applications at ambient temperatures from $-30\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$. The electronics inside the device are dimensioned for temperatures between $0\text{ }^{\circ}\text{C}$ and $+50\text{ }^{\circ}\text{C}$, with corresponding air-conditioning in the control cabinet.

With its device front in degree of protection IP66 (dust-tight and protected

against heavy water jet spray) and its suitability for outdoor applications in accordance with NEMA Type 4x, the panel is perfectly suited for harshest application conditions, also supporting its operation in regions subject to high humidity. A Temperature Extension Kit (TEK) by Siemens is optionally available for the panel as climate controller. The TEK facilitates the panel's application in the extended temperature range from $-30\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$, controls the control cabinet's heating or cooling and only switches the panel on upon attainment of its operating conditions.

"Already the device's initial switch-on in our yard convinced our customer NPS of having found the suitable solution for desert applications in the daylight-readable MP377 panel by Siemens", states Dipl.-Ing. Harald Sommer, hydraulics project engineer at Pleiger Maschinenbau. Its high luminosity and extended operating conditions were considered obvious benefits straightaway.

Competency and know-how in the field of I&C

Pleiger Elektronik represents one of four business units of the Pleiger group of companies originating from the machine factory founded in 1925 and meanwhile has a headcount of approximately 40 permanent employees. For more than 45 years, the company has specialized in the planning, configuration, development, production, installation and maintenance of various electronic devices in the field of instrumentation and control. The company's application experience spanning several decades results in versatile sector know-how and a high competency for the efficient and economic implementation of complex solutions for control engineering, marine electronics, plant automation, process control engineering and telecontrol engineering.

Competency and know-how in the field of mechanical engineering

Pleiger Maschinenbau offers comparable capacities and competencies for hydraulics, control engineering, naval engineering, wastewater engineering and metal foundry.

Historically, both business units cooperate very closely but not exclusively.



With the daylight-readable SIMATIC Multi Panel MP377 by Siemens, Pleiger Elektronik for the first time employed a central, daylight-readable operator panel instead of diverse illuminated pushbuttons. The operator is provided with more comprehensive process information in a transparent form.

Increased options for rapid troubleshooting

The 15" touch display (1024 x 768 pixels, 16 million colors) offers manifold options for the realization of demanding graphical visualizations. Pleiger Elektronik utilized this feature together with the tried-and-tested SIMATIC WinCC visualization software to visualize all important HPU operating states on three transparent operating screens. In addition to damper position, oil pressures, temperatures and filling levels, the main screen also shows the states of the triple redundant ("2 out of 3") limit switches for monitoring of the damper end positions as well as those of the corresponding sea air systems (supplied by a different manufacturer) for reliable sealing of the flue gas. Any faults in the respective plant sections are indicated at a glance by means of color changes. The main screen also integrates all (analog) display elements which were previously separately installed, which reduces hardware and wiring expenditures.

The second screen shows detailed states of all electrical components, providing the operator with direct insight as to fault location and required intervention. With the previous concept, a single group fault message was output and the operator had to search the entire hydraulic system for the fault cause in order to take respective action. In contrast, the new solution considerably reduces downtimes and thus contributes to an increased availability and supply reliability of the gas and steam



The central panel indicates the states of all HPU components on only two operating screens and thus facilitates rapid and comfortable troubleshooting – which facilitates considerably reduced downtimes in case of fault.

power plant. In the described case, it also supports the maximum productivity of a seawater desalination plant installed downstream the power plant.

"The initial extra costs are amortized over the operating period, sometimes even as early as during initial commissioning where a fault can be rapidly rectified thanks to increased transparency, making a complete shutdown and restart of the power plant unnecessary", summarizes Dipl.-Ing. Jürgen Rautert, commercial director and authorized representative of Pleiger Elektronik. In other words: Also in this context, the total cost of ownership (TCO) and the benefits over the course of operation are decisive for efficiency analysis.

The third screen, which shows a legend of the symbols used in the other screens via finger touch, eases the training of new operating or service staff. (In this context, additional operating reliability could be effortlessly realized with the help of the Multi Panel's language selection option not requested in the project's first instance.)

The automation expert benefits from the new operator panel's advantages both in terms of reduced expenditures and time as the solution can be easily transferred to comparable plants. Subject to corresponding ambient conditions, the HMI project can also be realized with the standard version of the SIMATIC Multi Panel MP377 Touch in a function-compatible manner (exception: dimming function).

Redundancy for high availability

The HPU is controlled by two redundant SIMATIC S7-300 controllers which synchronize after every user program cycle in intervals of approximately 15 milliseconds. This cost-efficient software redundancy is sufficient for this application as the process in question is not time-critical. The diverter damper's normal traversing from one end position to the other takes roughly 60 seconds. Also the boiler's emergency closure via the hydraulic accumulator in case of a total power supply failure can be effortlessly realized in the requested time period of 20 seconds. Both controllers are hardwired to the superior control center via coupling relays from where they receive their commands during automatic operation. For the transmission of further process information from the field to superior levels, the route via Modbus TCP/IP, which is widely used in power plant applications, and corresponding communication processors (such as CP343-1 with Modbus module) from the SIMATIC Net portfolio were selected. Also the Profinet technology, which is increasingly developing into the new industrial communication standard, can be employed where permitted by the respective specifications. In this case, also the separate communication processors can be done away with and both controllers as well as the operator panel can be integrated in a consistent communication concept.

From a Renowned Source

The decision-makers of the mechanical engineering and electronics departments of Pleiger as well as the supplier NEM Power-Systems rely on automation technology by Siemens due to its worldwide renown for reliability and ruggedness, global acceptance and, above all, rapid availability. If required, also local automation engineers, system integrators or global Siemens support centers are able to provide support, deliver spare parts and replace devices. Also this benefit contributes to high system availability and corresponding productivity.