



Why a leading manufacturer of hardness testing machines is the first to use a new type of I/O system based on individualised wiring boards and functionally optimised modules in series production.

PLC Put to the Test

Simply plug functional modules as a whole into preconfigured circuit boards instead of time-consuming and error-prone wiring of individual wires: This is the basic concept behind the new 'X-DIAS' I/O system, which SIGMATEK officially launched last year at the SPS trade fair as an addition to its proven 'S-DIAS' control portfolio. It was developed by the local automation expert at the suggestion of and in partnership with Emco-Test, a long-standing customer, also based in Salzburg. The globally successful manufacturer of high-quality hardness testing machines was looking for a solution that would, on the one hand, keep the packing density of the

increasingly complex control system under control despite the continuously growing range of variants and functions and, on the other hand, make the connection technology faster and easier to install, future-proof and yet economical – all while maintaining a high degree of modularity and production volumes in the mid three-digit range. This seemingly impossible balancing act was achieved in the form of the jointly developed I/O innovation 'X-DIAS', which is now going into series production in Emco-Test's latest generation of hardness testing machines, the 'Visionline'.

By Thomas Reznicek



With its new 'VisionLine' generation, Salzburg-based hardness testing machine manufacturer Emco-Test aims to set a benchmark in the test load range from 10 gf to 3,000 kgf. The innovative eight-fold tool changer for lenses, indenters, lasers and load extensions enables quick adaptation to the respective test requirements.

Emco-Test, based in Kuchl (Salzburg), has a broad customer base that includes manufacturers in the metal-producing and metal-processing industries, hardening companies, machine builders, producers in the automotive, railway and aircraft industries and their suppliers, as well as electronics manufacturers, testing laboratories and research institutions. "We position ourselves in the premium segment of hardness testing and want to offer the best customer benefits here," emphasises Michael Grandits, Head of Development & Innovation at Emco-Test. While Emco-Test's first hardness testing machines over 70 years ago were purely mechanical solutions, today's machines are equipped with state-of-the-art automation technology: sensors, image processing, drive technology, motion control, HMI and a wide range of software, including AI-supported evaluation, ensure fast, uncomplicated semi- or fully-automatic testing processes, with comprehensive data management. "The latest generation of our universal hardness testers stands for efficiency and simplicity, setting new standards in many aspects," says Michael Grandits enthusiastically when talking about the new VisionLine. "This takes micro and macro hardness testing to the next level." The automation technology at the heart of the versatile VisionLine series is SIGMATEK's S-DIAS control system in combination with the new X-DIAS I/O system, which was developed specifically for this application.

Long-standing technology partnership

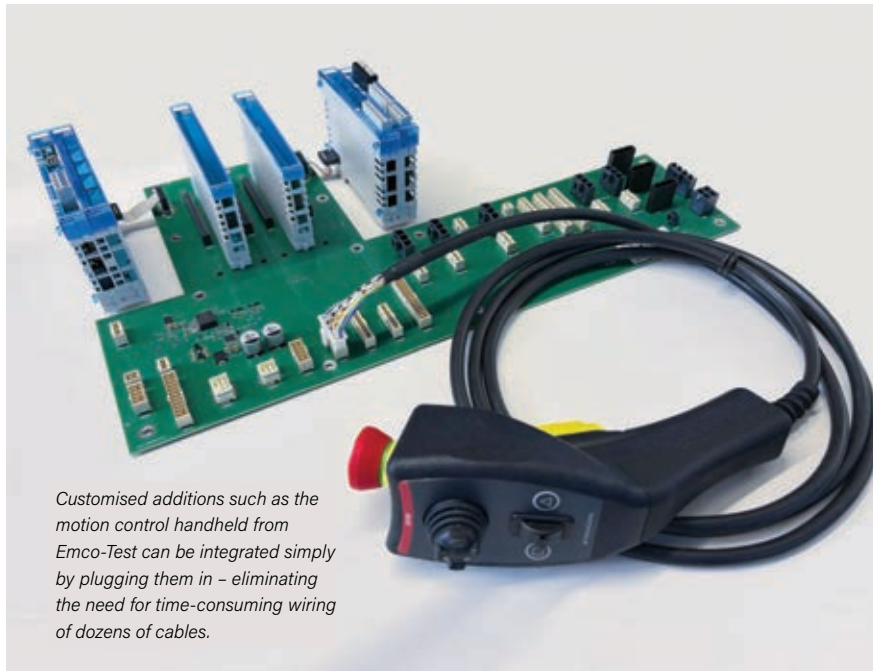
Automation specialist SIGMATEK, based in Lamprechtshausen in Salzburg, and Emco-Test have been working together for almost two decades in a steadily growing technology partnership. It all began with Emco-Test's decision to build up more automation expertise in-house and to replace the externally programmed control solution based on a customised circuit board, which had been purchased until then, with an industry-proven PLC with modern programming options. In a selection process, SIGMATEK won the race with its 'C-DIAS' PLC, the predecessor generation of the current 'S-DIAS' series. "Our goal was to become more independent in terms of control and to have as many competencies as possible in

our own hands," recalls Thomas Kainhofer, electronics developer at Emco-Test. "Highly reliable hardware and the willingness to adapt it to our specific requirements, an extremely functional, modern engineering tool with object-oriented programming that was already available at the time, which enabled us to work sustainably and use our own source code right from the start thanks to its reusability, the excellent support provided by the application engineers and, of course, the advantages of geographical proximity – at SIGMATEK, the whole package was right from the start." When the particularly compact 'S-DIAS' control generation was launched in 2012, Emco-Test was one of the first customers to use it in series production. Many of the 'S-DIAS' modules that have been added to the product family over the years



Emco-Test integrates all electronics directly into the machine – there is no separate control cabinet. The 'X-DIAS' function modules can be easily plugged into the individually designed circuit board, which also contains fuses, isolating relays and the necessary interconnecting wiring. Above this, there is space on an additional DIN rail for the CPU unit, which varies depending on the machine variant or optional equipment, and other modules from the 'S-DIAS' series.

originated from a specific requirement of the hardness testing machine manufacturer. "We don't use a classic control cabinet, but integrate all the electronics directly into the machine. This means that issues such as flexibility through modularity, installation space and packing density, supplying any »



Customised additions such as the motion control handheld from Emco-Test can be integrated simply by plugging them in – eliminating the need for time-consuming wiring of dozens of cables.

based on the established 'S-DIAS' system. The I/O modules are therefore just as robust and vibration-resistant – and, with dimensions of 12.5 x 102 x 63 mm (width x height x depth), they are even more compact thanks to the elimination of the I/O terminals. Five 'X-DIAS' function modules are currently in use in this application: The digital 'X-DIAS' mixed module 'XDM 161' offers eight digital inputs (+24V/3.7 mA/5 ms) and eight short-circuit-proof digital outputs (+24 V/0.5 A). The input module 'XAI 022' with two analogue inputs is used to evaluate resistance measuring bridges (e.g. strain gauge force transducers) and, with a 24-bit resolution, delivers measured values with a total accuracy of $\pm 0.035\%$. The 'XPL 201' LED module can be used to control two LED strips with a maximum of 512 RGB pixel LEDs. The fourth module in the set, the 'XIO 341' multi-I/O module, has four LED outputs in the range of 0–1 A, three analogue inputs in the range of 0–5 V and a 5 V sensor supply, and is

"With 'X-DIAS', SIGMATEK has managed to make the 'S-DIAS' technology, which we consider to be very good, even simpler in terms of less wiring effort and fewer potential mistakes."

Michael Grandits, Head of Development & Innovation at Emco-Test.



"We see significant advantages for our international customers when it comes to servicing. Accessibility to the function modules is now easier thanks to the elimination of wiring, and the clear coding of the modules and connectors on the circuit board means there is no longer any risk of confusion."

Thomas Kainhofer, electronics developer at Emco-Test.

modules and, above all, wiring have been occupying us for a long time due to the ever-increasing variety of variants and the associated complexity of our testing machines. For example, the new VisionLine requires up to six axes to be coordinated in terms of control technology in its largest configuration, but only one in its smallest. We were therefore looking for a solution that would minimise the effort and potential for mistakes in wiring, reduce assembly times and enable us to maintain our high quality standards in the long term," says Michael Grandits, reflecting on the initial situation that ultimately led to the new 'X-DIAS' I/O system.

The customisable standardised I/O solution

"We analysed and discussed various ideas in several workshops – there are similar systems on the market, but they differ from our concept in the details," reports Thomas Kainhofer on the joint development work with SIGMATEK. The most promising approach proved to be decoupling the connections from the control electronics module by establishing the connections via a customisable wiring board onto which the required function modules can be easily plugged. Electronically, the new 'X-DIAS' I/O series is

suitable for high-performance LEDs, for example for lighting image processing applications. The 'XBL 011' blind module active on the bus completes the quintet of 'X-DIAS' modules installed and can be used as a placeholder for later system expansion. "The circuit board has the appropriate holes at the corresponding module position – the unique mechanical coding prevents misplacement and thus incorrect wiring," explains David Eisl, the SIGMATEK sales engineer in charge of the project, adding: "There are virtually no limits when it comes to connectivity – any connectors can be attached to the circuit board, and fuses or isolating relays can

Hardness testing machines from Emco-Test

Whether standard testing methods according to Rockwell, Brinell, Vickers and Knoop, whether metals, plastics or carbons – with its wide range of hardness testers, the Salzburg-based manufacturer Emco-Test covers a wide variety of applications, offering solutions for load ranges from 0.00025 to 3,000 kg and supporting semi-automatic and fully automatic hardness testing in accordance with all established standards. The origins of Emco-Test date back 71 years, when a hardness testing machine designed in a small department within the former Maier&Co Maschinenfabrik (later Emco Maier) was registered for a patent. Numerous inventions followed in the next few decades, including the closed-loop control system for load application in 1989, which for the first time enabled all common testing methods and a wide range of load levels to be implemented with a single universal hardness testing machine, and which still forms the technological basis of many modern testing systems today. In the mid-1990s, Emco-Test was established as an independent company. Since 2021, it has been part of the German ZwickRoell Group, headquartered in Ulm, Germany – a leading global manufacturer of static materials testing machines with around 1,800 employees and sales and service branches or representatives in more than 50 countries. Currently, around 40 employees work at what is now the ZwickRoell competence centre for hardness testing.

be placed there along with intermediate wiring" Emco-Test engineers are already making extensive use of this technology by consistently using pre-assembled cable harnesses with coded connectors instead of wiring them individually as they did in the past. "Each connector is only available once on our circuit board with the respective coding – this prevents the risk of incorrect connection from the outset," says Thomas Kainhofer, emphasising this significant



Technology partnership on equal terms: Emco test electronics developer Thomas Kainhofer and SIGMATEK sales engineer David Eisl (left to right) are delighted with the successful completion of the 'X-DIAS' project, which aims to increase flexibility for series machine manufacturers.

advantage. In addition to industrial Ethernet Varan bus, standard fieldbus and industrial Ethernet systems are available for communication with the various 'S-DIAS' CPUs. Application programming is also convenient with 'X-DIAS' using SIGMATEK's all-in-one engineering tool 'LASAL'

Advantages for series machine production

The 'X-DIAS' concept offers a flexible mix of proven standard I/O electronics from 'S-DIAS' and connection technology that can be individually designed by the OEM. "SIGMATEK has succeeded in making what we consider to be the excellent 'S-DIAS' technology even simpler in terms of reduced wiring effort and fewer potential mistakes. The option of being able to replace individual modules at any time without having to make changes to the wiring board and thus the connection of the sensors and actuators

makes the solution absolutely future-proof, as it can always be kept up to date with the latest technology," says Michael Grandits, praising the result of the joint efforts. "Furthermore, we can now integrate the electronics more clearly, thereby enhancing the impression of quality visually alone." Thomas Kainhofer adds: "We see significant advantages for our international customers in terms of service. Accessibility to the function modules is now easier thanks to the elimination of wiring, and the clear coding of the modules and connectors on the circuit board means there is no longer any risk of confusion." OEM customers can have the customisable wiring boards manufactured directly by SIGMATEK or produce them themselves. The layout of the boards can be freely designed – the only specifications concern the sizes of the slots for the function modules. SIGMATEK provides its own design guide for this purpose. "The 'X-DIAS' system increases flexibility for series machine manufacturers with medium to high production volumes, minimises wiring within the machine, reduces installation times and thus offers interesting technical and economic potential overall," summarises David Eisl, concluding: "Several other customers have already taken an interest in 'X-DIAS'."

INFOLINKS: www.sigmatek-automation.com
www.emcotest.com