Variable test depth

The combination of MDA and function test in the flying probe opens up new opportunities

In many test areas, a function test is the only test process used. In particular in areas with small to medium series, large batch variance and a high variety of types, it used to be difficult to achieve the hoped-for quality costs with other test processes. In this case, the flying probe technique offers new approaches.

Since 2007, ITOCHU SysTech GmbH and inovel elektronik GmbH have worked together to develop hardware and software in order to allow the flying probe technique to be used in an optimum and standardised way for function tests. The Lynx and Merlin products are not only able to generate extensive function tests ergonomically, but also the integrated programming unit enables in-system programming of blocks. The objective of achieving the lowest possible quality costs with maximum flexibility and great test depth is coming closer. The flying probe technique enables sequential testing of components on the populated subassembly. Movable needles contact test points or component pads with high speed. There is no need for an adapter, the test program is created highly efficiently from the CAD data of the subassembly. Knowledge about the function of the subassembly is of subsidiary importance for the test. Fault localisation is quick and easy, because each component is included as a rule. Integrated vision systems provide a further increase in test coverage.

Can the advantages of the flying probe also be used for the function test?

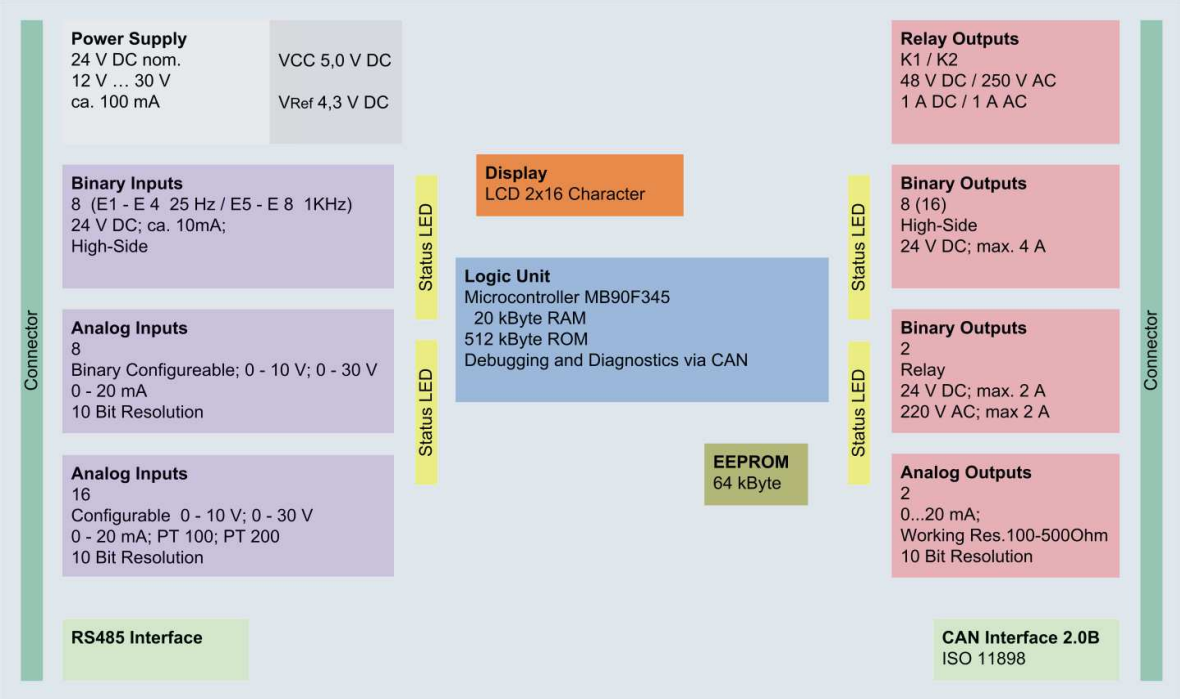
By combining or integrating the function test in the flying probe, it has been possible to achieve a flexible overall system with completely new opportunities.

The setup costs are significantly reduced. The ability to process two test processes in one test instance significantly reduces the handling complexity.

The costs for adapters are as low as possible, as are the costs for associated activities such as maintenance and logistics.

However, it is very important that the combination of function and MDA test in the flying probe almost eliminates the disadvantages of both test processes.

Flying probe tester APT9411CE



System overview of CANopen-Compactcontroller

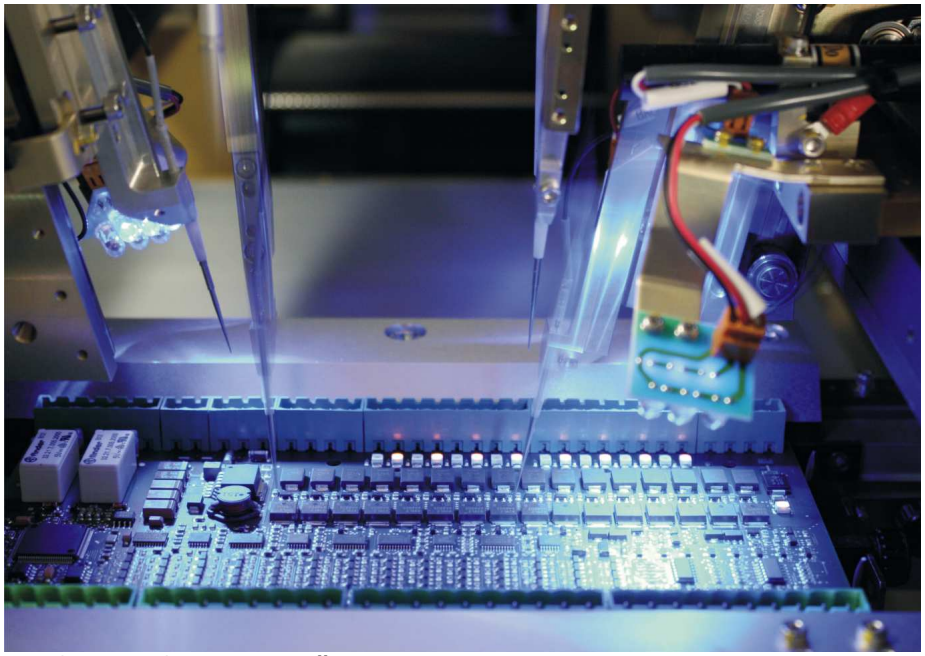
Conditional MDA test reduces the test time and permits a qualified statement about the fault

A significant feature of this combination is the option of generating conditional MDA tests. This means components that were assigned to a function block are only tested if the block function is not given. The advantages are striking: Not only is it possible to achieve great test time savings with greater coverage, but it is also possible to define function tests with a qualified statement about the fault.

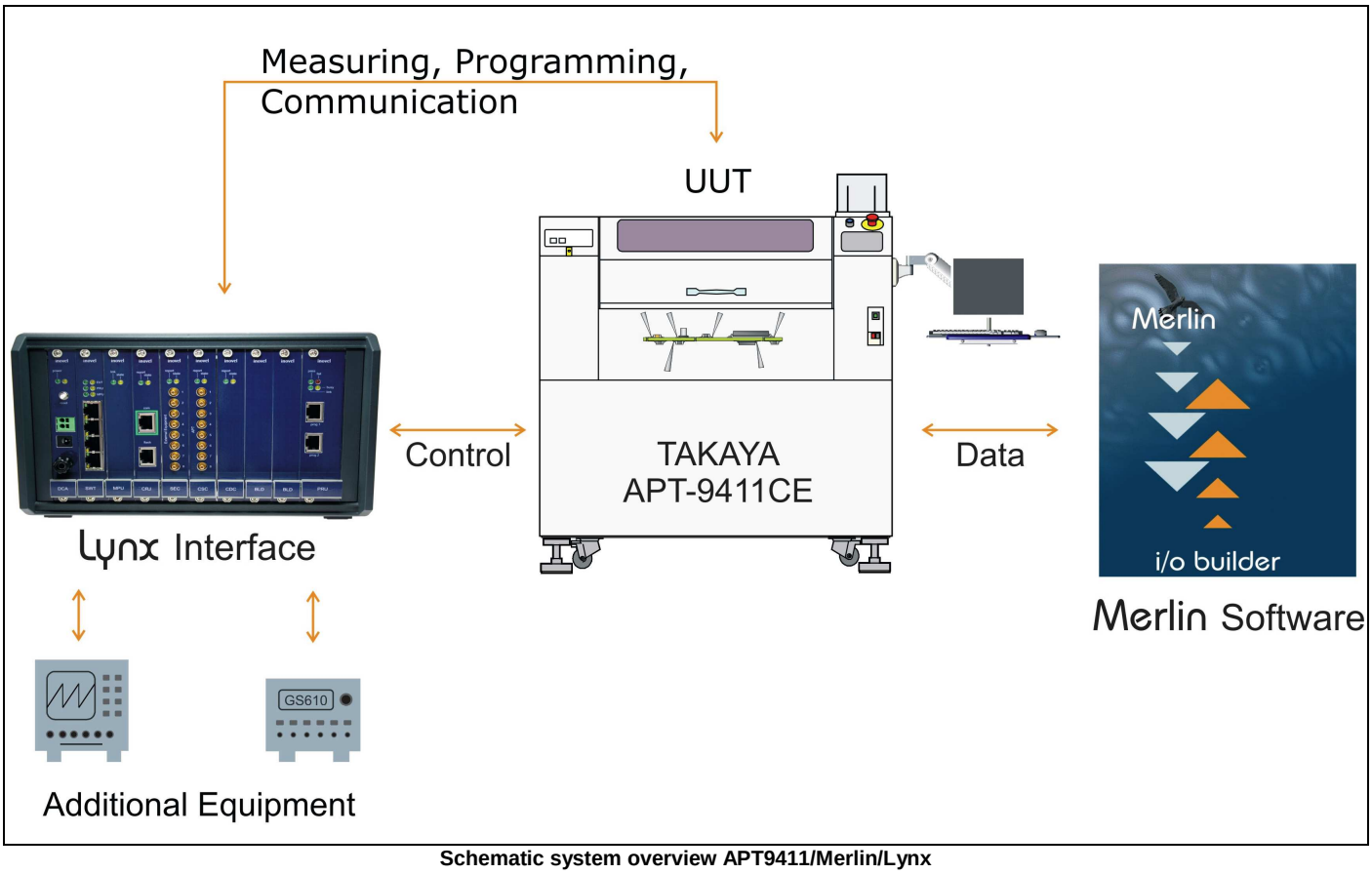
In order to generate test steps that are as efficient as possible, block structures once defined are stored in a database with the settings of stimulation and measuring instruments. New projects can then automatically be investigated for existing block structures. There is no need to define each block individually in projects that have identical function blocks. This means the complexity of program generation can be significantly reduced.

Certain MDA tests are generally performed ahead of the functional tests in order to preclude damage to the subassembly. In this way, for example, components with swapped-over polarity or short circuits can be detected before the supply voltage is applied.

The objective of this procedure is to achieve maximum test coverage



Test CANopen-Compactcontroller



Schematic system overview APT9411/Merlin/Lynx

with the lowest initial costs.

Merlin i/o builder is available with a floating license, and can be installed as often as required. Monitoring is performed by means of a license file, no dongle is required.

Lynx – a flexible communication and programming interface

The Lynx hardware package developed especially for TAKAYA flying probe systems can connect external measuring and stimulation electronics freely to the internal APT measuring bus, and therefore to the test needles (fixed or flying). A Linux operating system runs on the internal computer unit. Communication with the test system computer is via Ethernet.

In the full deployment, a programming unit is integrated which can be used for integrating block programming into the test procedure.

At present, all common in-system programming steps and approx. 3000 blocks are supported.

The programming system module of the Merlin i/o builder software assists the user with straightforward selection and storage options, and even database-assisted version management of the programming files and associated programming parameters for the target hardware. Traceability is completely provided.

An external programming unit with two channels is available for critical programming applications in which the cable length is problematical. This can be directly installed on the test specimen in the machine tray. The modular system structure makes it possible to integrate additional programming units. In this way, the number of programming channels can be adapted or parallel programming of several blocks made possible.

Lynx also allows tests of diverse interfaces such as CAN, RS232, RS485, I2C, USB, etc. These functions can be generated very straightforwardly with the Merlin i/o builder, even allowing "complex" communication with the test specimen.

Java classes which users can also define and integrate themselves, also enable quite special protocols to be implemented. Standard protocols such as CANopen are already implemented in the basic package.

In addition to the TAKAYA measuring electronics, the Lynx interface also makes it possible to incorporate external LAN-capable measuring and stimulation devices into the system in a straightforward manner.

The Merlin i/o builder supports these devices as well as all other devices already integrated into the TAKAYA, such as the Yokogawa GS610, programmable mains adapters, etc.

The particular current machine configuration can be defined by the user on a graphic interface and assigned to a project.

In the near future, an offline version will enable debugging on the laboratory bench, thereby reducing "downtimes" on the production machine. Another objective of this offline version of Merlin and Lynx is to be able to offer a flexible desktop solution for function tests and programming to be used in small series and laboratory applications.

Sample application CANopen-Compactcontroller

Basically, there are various possibilities for combining the procedures into the system, depending on requirements. As a rule, an MDA test always takes place ahead of the function test in order to locate faults which could lead to irreparable damage to the subassembly if the supply voltage is contacted. Depending on the requirement, the MDA and function tests can be processed in separate programs. In order to minimise test times, it is a good idea to combine the two procedures in conditional tests. The software for writing programs supports all variants.

In the following example, the CANopen-Compactcontroller block (see Fig. System overview of CANopen-Compactcontroller) is used for describing a function test procedure.

The programming and communication interface is contacted by means of a standardised, fixed needle package from the solder side. First of all, the current consumption and all analog voltages on the board are measured.

Once the bootloader and the application havebeen uploaded into the controller memory, the test system stores production-relevant data in the test specimen's memory.

On the analog inputs, the offset and gain factors are automatically compared in the various modes (4 – 20 mA, 0 – 10 V, 0 – 30 V, PT100, PT200). For this purpose, the corresponding channel of the block is switched to the required range. A high-precision source sink stimulates the corresponding analog values by means of flying needles on the inputs of the subassembly. The correction values for offset derived from the result are stored in the test specimen's memory. Even the comparison of analog outputs is performed in a corresponding way.

The procedure used for the digital inputs is similar, stimulation is by way of the source sink, reading back via the subassembly controller. The result is corrected from the subassembly via CAN bus, and compared by the test system.

A load test of the semiconductor outputs can also be performed under realistic conditions, the outputs can be set via CAN bus from the TAKAYA test program. The source sink is contacted by the flying needles, thus achieving a load current of up to 3 A. A corresponding procedure is used with the relay outputs. The internal measuring unit of the flying probe measures the contact resistance values. The flexible communication unit tests the RS485 interface of the module by means of the flying needles.

Conclusion and outlook

Integrating the function test into the flying probe has created a very flexible solution that is optimally suited to relatively small and medium batch sizes. All important process steps are performed in one working operation: the subassembly is put through the ICT test, programmed, calibrated and its function is tested. There is no need for complicated test setups, the programs and results are reproducible and can be documented in a standardised way. An extensive test is possible and economical even at prototype status, and meets the requirements of the series production test. Even topics such as prototype production and end-of-life management (which are always a difficult topic from the test area perspective) can thus be achieved with the lowest quality costs.

Highly complex subassemblies with shorter and shorter product lifecycles combined with a high type variety mean that innovative test strategies are becoming more and more important. The combination of different test procedures without the need to dispense with flexibility lays the ideal groundwork for ensuring a competitive edge in a dynamic environment.

The TAKAYA flying probe system and Lynx/Merlin hardware/software provides a solution that meets the individual test requirements of a wide range of users.

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