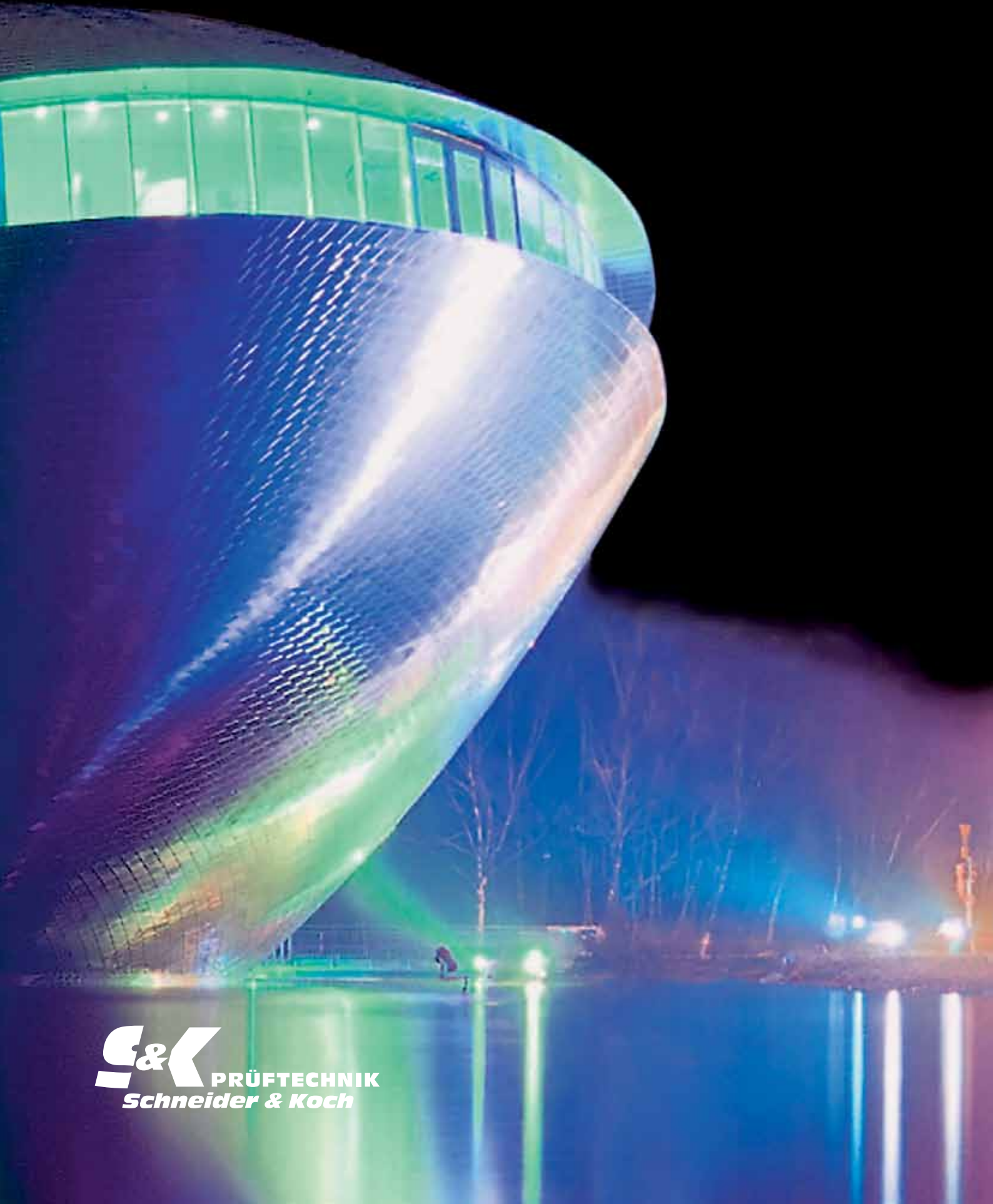
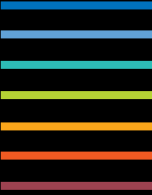


AOI Automatic Optical Inspection

ATE Automatic Test - Equipment

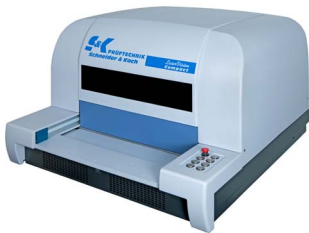


Automatic Optical Inspection

MachineVision



LaserVision Compact



LaserVision Compact Twin



LaserVision Inline / Standalone / Twin



LaserVision LED - Testsystem



Configurable software



In-Circuit-Test

Services and applications



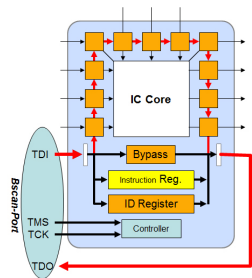
Ti2GER I-tabletop system



Ti2GER I-System



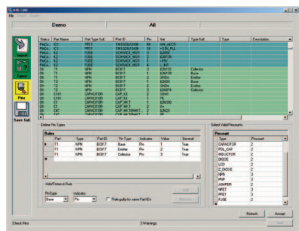
BoundaryScan (BS)



Test fixtures



Software for test systems



Functional Test

Services and applications

Function test systems

Ti2GER-family



Function test systems

Ti2CA Compact



Customer-specific test systems



FCT-fixturing



Software ATE-Production



Test Services

Inspection and repair

- Automatic optical inspection (AOI)
- High Voltage test
- In-circuit test
- Functional test
- On-board /
in-circuit programming



Consulting

Development of test concepts

Project management

Training courses and seminars

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Prüftechnik Schneider & Koch –

innovation, quality and experience “made in Germany”

“Starting out, nothing is impossible”. With this attitude the 1982 founded and ISO-certified company became a pioneer in the areas of Automatic Optical Inspection (AOI) as well as Automatic Test Equipment (ATE). Partnerships with renowned manufacturers of test systems and expansion of its representation in Europe and Asia have taken Prüftechnik Schneider & Koch into a new business dimension over the past years. A young general management duo, highly qualified employees and regular participation in trade fairs keep Prüftechnik Schneider & Koch in close contact with their customers.

About three decades ago, the founder of our company, Hans-Otto Schneider, set new standards when he established the core business area of automatic testing. Prüftechnik Schneider & Koch Ingenieurgesellschaft mbH was to become what is now the oldest company in the area of ATE in Germany. In 1990 we relocated to the Technology Park of Bremen University in order to create new highlights in a place where science and business meet. The architecturally and technically sophisticated appearance of the neighbouring Uni-

versum© Science Center symbolises our quality standards and at the same time stands for the location of our company at Bremen Technology Park. It is here that according to Bremen's self promotion economic success is generated from knowledge transfer. This is a promise proven to be kept by Prüftechnik Schneider & Koch. With the experience of decades and qualified specialists, we advise our customers in the following areas:

- Automatic Optical Inspection (AOI)
- Automatic Test Installations (ATI)
- Fixture Construction
- Construction of Appliances
- Test Services
- Consulting

The test solutions we design are an important factor for the competitiveness of our clients' products. Our customers are from various industries such as industrial electronics, medical electronics, aircraft electronics, railway electronics,

“Measurable increase of product quality and assurance of your business success due to reliable and innovative solutions”



Company domicile of Prüftechnik Schneider & Koch at Bremen Technology Park.

military technology or automotive – to name but a few.

To be able to offer our customers a wide range of effective test solutions, we have concluded partnerships with renowned manufacturers of test systems such as Teradyne, Rohde & Schwarz, ATX, Ingun, GPS sowie Rundfunk Gernrode.

For a future-oriented company like Prüftechnik Schneider & Koch, qualified training and competence building of the employees are basic conditions for developing innovative products and customer solutions. Therefore, we are also partners of the **FED - Fachverband Elektronik-Design e.V.** (professional association for electronics design).

Apart from the cutting edge technological knowledge we also keep customer orientation in mind. Today our motto “Starting out, nothing is impossible” is still valid, with regard to

technical problems as well as in project management. Paths in the company are short and those in charge have extensive decision competences. This means orientation towards innovation and quality as well as a high degree of flexibility and fast responses – an advantage for our customers.

As a customer, try to challenge us with your problem and see our company's approach for yourself in cooperation with us. Uncompromising striving for top performance in technology, quality and reliability is typical for Prüftechnik Schneider & Koch; they are important factors for our success “made in Germany”.



Prüftechnik Schneider & Koch is regularly represented at the trade fairs SMT/HYBRID/PACKAGING in Nuremberg and productronica / electronica in Munich.



Production of test systems in the Stadthagen branch of Prüftechnik Schneider & Koch.





Our Orientation – efficiency of your production

Due to increasing miniaturisation, electronic components and appliances produced with modern production technologies can be tested with conventional electrical test procedures only in a limited way and with a considerable effort. Different test procedures must be employed in order to fulfil high quality standards. They must be usable independent of structure sizes, component and electrical access fast and easily.

No manual visual inspection necessary

Optical test procedures fulfil these requirements. There is no need for electrical contacting and make tests possible that up to now could not be realised with electrical methods. In addition, the otherwise common manual visual inspection becomes unnecessary.

LaserVision offers an economic introduction into AOI. Since all systems use the same software and since the same illumination is used, existing programs can be transferred without problems. This constitutes optimal investment protection and high flexibility for future changes in production.

Left: Medical technology such as computer tomography requires a high degree of reliability. Therefore, electronic systems must be tested electronically.

Our systems – your performance

MachineVision

System for integration into customer-specific environments such as installation in conveyor roads or in test fixtures to carry out:

- Inspection of selective solder joints
- Display test
- Illumination measurement
- Character verification
- Print pattern control
- Mechanical measurement



LaserVision Compact

AOI table top system, automatic drawer, flexible test specimen mounting, colour camera module with telecentric lens and configurable resolution, lighting unit consisting of individually programmable modules. Optionally with side view function and rotatable unit of measurement.



LaserVision Compact Twin

AOI stand-alone, automatic drawer, flexible test specimen fixture, tests double-sided PCBs simultaneously from above and below, a colour camera module with telecentric lens and configurable resolution. Optionally with side view function.



FEATURES

- High efficiency and examination depth up to 01005/0.3 mm pitch even for small series and a wide product range
- Fast and comfortable test program generation
- Low pseudo fault rate due to flexible illumination and telecentric lens.
- Reduced serial debugging effort due to optimised component recognition
- Uniform software with free software updates
- User-oriented illumination profiles for various test criteria
- Lateral cameras optional
- Open interface for external QS systems / MES
- Offline programming, offline debug with original test images



LaserVision Inline /Standalone

AOI in-line, automatic width adjustment, two colour camera modules with telecentric lens and configurable resolution, lighting unit consisting of individually programmable modules. Optionally with side view function.

Also available as standalone system with manual drawer, and flexible test specimen fixture.



LaserVision Twin

AOI in-line, tests double-sided PCBs simultaneously from above and below. Automatic width adjustment, four colour camera modules with telecentric lens and configurable resolution, lighting unit consisting of individually programmable modules on the top and bottom side.

Optionally with side view function.

LaserVision LED Test system

Combination of electrical and optical test for LED-units. Inline - fixture can be used for double-sided PCBs. The test uses the unique combination of photometric measurement and camera inspection under requirements of inline production.



APPLICATION AREAS

- Examination for presence and polarity of THT and SMD components
- Examination of packing angles from 0 – 360°
- Exact component position (offset, angle)
- Solder joint examination on all components (SMD and THT)
- Short-circuit test (solder bridges)
- Co-planarity and component height measurement via laser (optional)
- Component character verification
- Display test (dot matrix, Multi-segment, LCD, LED)
- Barcode reading via camera
- Setup verification/initial sample testing
- Solder paste inspection

LaserVision – our leading edge

Optical test procedures are particularly suitable for checking the production process. They can be used to identify and rectify faults in time. Therefore, examination can be reduced to the electrical function of the component.

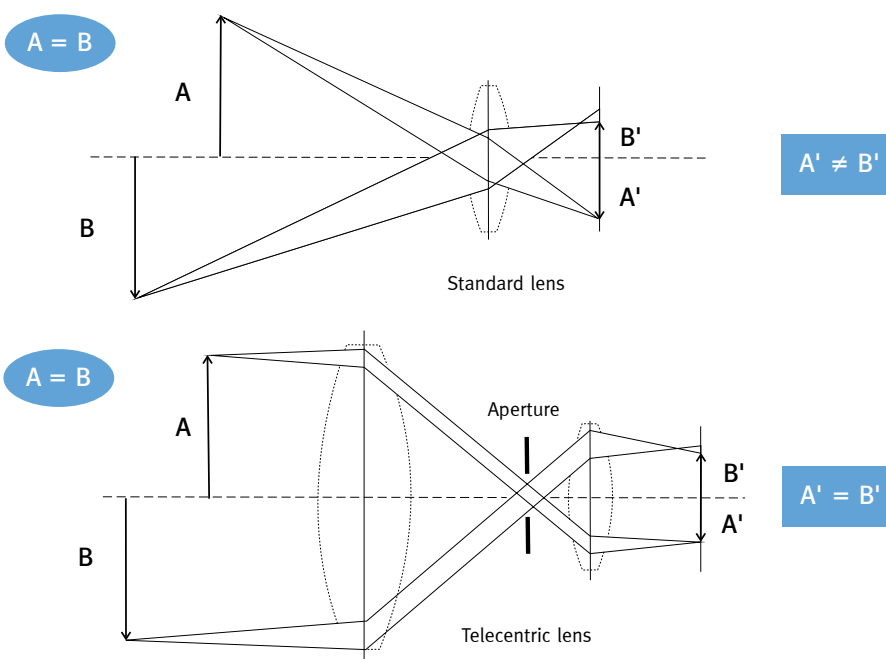
This is the basis for reliable process control. **LaserVision** is designed for checking the placing and soldering process. This is valid for conventional placing of leaded components (THT) as well as for SMT components. Production faults such as missing or incorrectly mounted components as well as open solder joints and short circuits can be reliably recognised without major programming effort. **LaserVision** provides an optical inspection system that combines three different test procedures (more information about this on pages 10 and 11). This will achieve a particularly high fault coverage and low pseudo fault rate. Therefore, **LaserVision** is designed for process control in any type of electronics production.

Innovation is always oriented towards customer benefits: **LaserVision** has a modular system architecture and can be adjusted easily to different requirements by means of options. The system is available in different variations: as table top system, standalone or in-line system, as well as system for testing both sides of double-sided PCBs at the same time. For integration into an automatic production line, **LaserVision** has a transport system. Barcodes can be read. Communication of the system with the production line is done by means of SMEMA / Siemens standard.

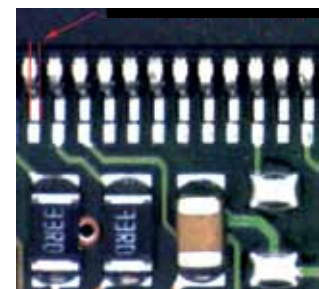
Telecentric colour recording module

Optical measuring and testing technology requires imaging systems that ensure constant image size over a certain range of object and image position. So-called telecentric images fulfil this requirement due to a particular beam control (cf. diagram below). The telecentric colour camera module of the **LaserVision** systems generates high-contrast and warp-free images without parallax faults. Besides comfortable fault visualisation, this allows precise and reliable measurements as well as a wide testing range in terms of various testing sample features.

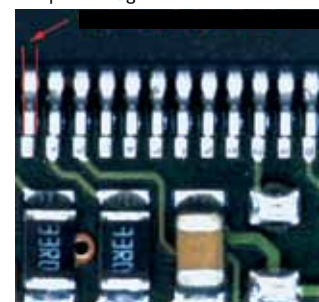
Principle of the telecentric image: Objects are captured without warped perspective in spite of differences in component height. The main beams in the object space are all parallel to the optical axis. Therefore, the front lens has to be at least as big as the object to be imaged.



Parallax faults on the edge

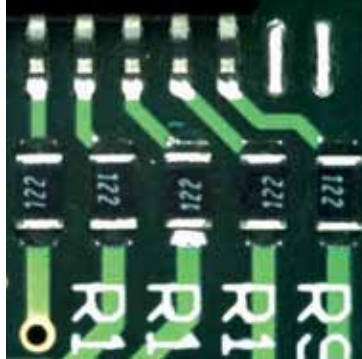


Warp-free edge

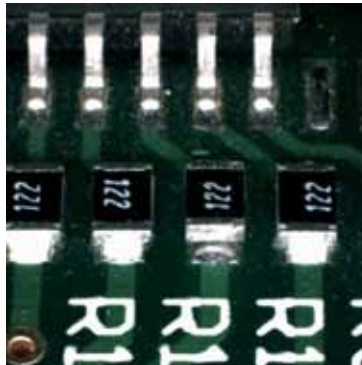


Angled view inspection: High depth of focus, short cycle times

Since electronic components are increasingly complex and components and solder depots are becoming smaller whereas the packing density is continuously growing, automatic optical inspection (AOI) with conventional orthogonal cameras is reaching its limits. In addition to the main camera it is therefore possible to equip **LaserVision** systems with an angled view module which generates additional image information. As a result, hidden solder joints can be examined reliably, e.g. on PLCCs or J-leads. Due to the high resolution ($\sim 12\mu\text{m}$) lateral inspection of very small components such as QFNs is also possible. **LaserVision** systems are in particular characterised by very short cycle times. The reason is compact integration of the angle vision module into the sys-



Solder joints in orthogonal inspection



Solder joints in angled inspection



Software interface LVInspect

tem illumination, which makes additional procedure positions redundant. In addition, the high-quality optical system ensures an exceptionally high depth of focus.

Angle vision option even for small batch sizes

The angle vision module is available and can be retrofitted for all AOI systems, from tabletop system to large in-line systems.

Inspection systems can also be individually configured; therefore they offer flexibility for efficient production, for high-mix and low-volume production as well as for mass production.



AOI tabletop system **LaserVision Compact**: Colour camera modules with telecentric lens and configurable resolution. Optionally with side view function and rotatable unit of measurement.

Combined test methods – the sum of all options

Each test method has its strengths, but also its limits. Therefore, **LaserVision** combines three different procedures: Optical image processing, character verification and laser height measurement.

Each of these procedures has specific properties. Optical image processing allows recognition and analysis of visible features. Character verification allows examination of labels of any kind; laser triangulation on the other hand allows exact measurement of differences in height. Only combination of these three procedures guarantees optimal testing depth.

Optical image processing

The cameras used have different resolutions, so that in combination with the high processing height it is possible to examine very small as well as very large or tall components. Additional position correction by means of local fiducial markers allow fine-tuned positioning of the test windows in order to adjust to production tolerances. These functions make powerful solder joint examination on all components (SMD/THD) with short circuit test between neighbouring IC pins possible.

Medical equipment tests ensure the safety of patients and are subject to legal specifications.



Illumination

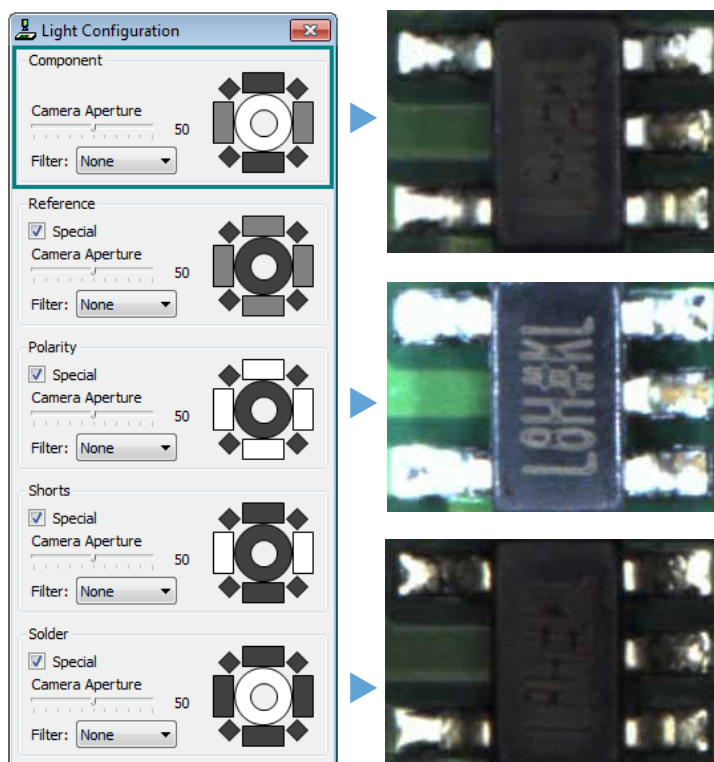
Using diagonally installed LED illumination units and a homogenous white LED ring lighting unit from above, the system separates the image and the assessment of image finding (presence and position issue) from feature examination (solder joint examination, polarity, short circuits etc.). For component finding it is important that edges and typical features are reliably detected. The angular installed illumination units in the system provide optimal conditions for making edges and features visible and assessable. For examination of solder joints, best results are achieved with a homogenous white LED illumination from above.

Character verification

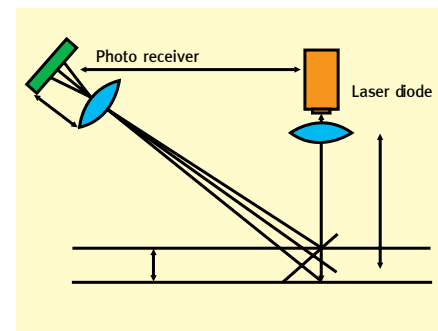
For integrated circuits it is particularly important to examine presence and orientation as well as whether the correct component type has been installed. To do so, the system has a procedure for optical character verification (OCV) and this way checks labels on components and on the circuit board. The characters are captured by a camera and compared to incorporated fonts by means of special software that is based on neuronal networks. In addition to that characters can be read by a „text-reader“ to compare them with the specification.

Laser height measurement

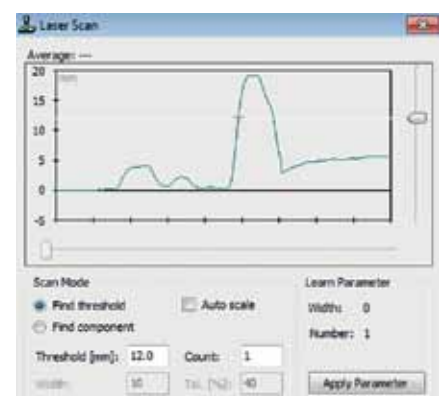
For touch-free distance measurement a laser beam is focussed on the measured object. By evaluating the diffusely reflected laser light with a position sensor the distance can be determined. Here too, standard testing routines such as measurement of height difference and co-planarity as well as optionally scanning of a height profile help to generate the test program. Laser height measurement is a good addition to image processing, because it can be used where due to lack of contrast or changing shapes and colours reliable evaluation of the camera images by means of image processing is not possible.



Optimal highlighting of features with the help of flexible LED lighting



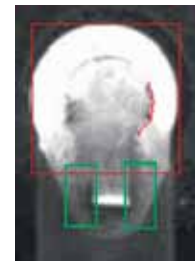
Principle of Laser height measurement



Height profile of a capacitor

MachineVision – custom solutions

With **MachineVision**, Prüftechnik Schneider & Koch provides customer-specific developments, independent of the type of test requirements for which these solutions are needed. The individual components of **LaserVision** systems are scalable and provide economic and powerful tools even for special requirements. System integration is planned and implemented as required.



CombiVision: Complete test solution in one appliance

To optimise testing depth, test methods can also be combined. Combination of electrical test and optical test results in considerable savings with regard to handling effort and space requirement. In addition, the joined repair station concept and statistic evaluation will optimise processes and reduce costs. Functional properties can also be tested. These include acoustic tests, examination of display modules such as display screens and LEDs as well as mechanical comparison, e.g. by pressing buttons via pneumatic pistons. The result is a better testing depth than for conventional AOI systems, and as a consequence high product quality at lower overall costs.

Test of selectively soldered THT solder joints

Special solutions can generally be integrated into existing production processes. These could be for instance examination of selectively soldered THT components that are provided for optical examination by means of in-line belts or robots. The parameters to be tested can be set according to the standard IPC 610.

Standard testing routines for solder joint examination on THT components:

- Wetting scope
- Presence of pins
- Solder cone
- Recognising bores
- Short-circuit test (solder bridges)
- Solder beads



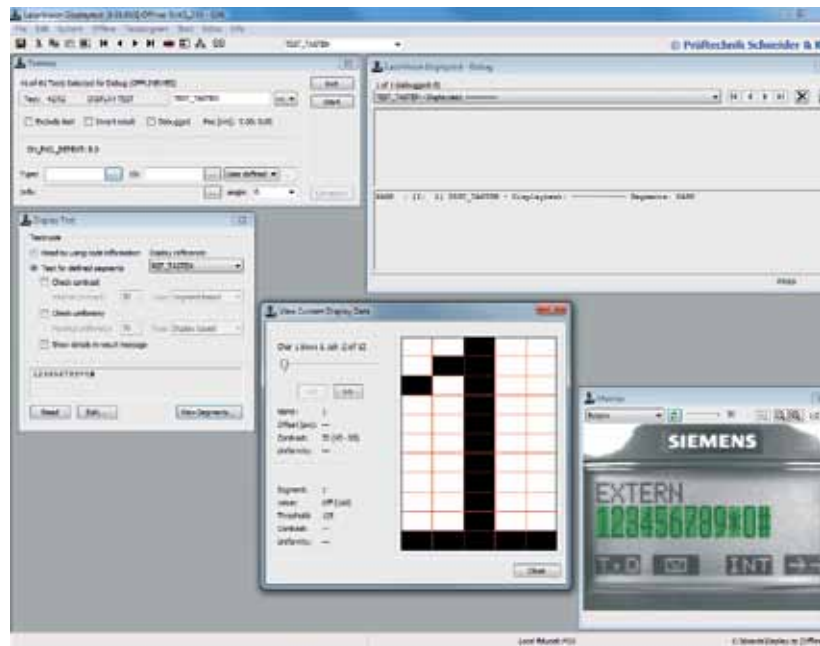
Reduces handling effort and space requirement: CombiVision provides a combination of electrical test and optical test as complete solution in one appliance

Display test

Displays such as dot matrix, multi-segment, LCD and LED can be reliably tested. Each dot is examined for brightness and contrast. In addition, combination with an electrical test is possible.

High test reliability is achieved by assessment of the background of each segment / dot in OFF mode so that dirt particles, faulty points or air inclusions in protective film can be almost fully eliminated. Production tolerances are automatically balanced by means of exact position, rotation and stretching correction of the display.

- Reading of the display content
- Contrast behaviour
- Uniform lighting
- Function test of each segment of LED / LCD / multi-segment or dot matrix displays



Software display test



A display is one of the most important elements of modern regulating system, e.g. in HVAC technology.

LED test system (AOI and functional test) for assembled LED boards

With the test system „LaserVision LED“ LED units can be tested in the production line to 100% in the cycle time. This includes the AOI inspection as well as the complete electrical test, and as a result of the combination also the optical measurements of the operated LEDs. Therefore, a 100% inspection in the inline process can be reached.

With the **test system LaserVision LED** by Schneiderb& Koch complete LED assemblies including the components can be checked automatically for

placement, solder joints, shorts, polarities etc.. In addition, photometric tests are possible. The unique combination of photometric measurement and camera inspection is used under requirements of inline production. LED lights can be tested completely as final products and / or in different production levels. Covered are therefore typical ceiling light panels, but the target markets are also manufacturing service providers (EMS), as well as the automotive industry. The test is done on the level of single LED.

The Software carries out a board correction first. With a special test routine the brightness of the switched on LED is determined.

The test region is always located on the same position of the UUT and is carried along in case of misalignment.

During the testing process the LED on the unit under test is supplied with the necessary power signal. Previous to the testing the set points are taken by means of a photometric measurement of a LED with typical values. This calibration can occur automatically directly in the test system while the measured values are put down as parameters in the test program. This process can be repeated at any time (e.g. at the beginning of a shift or at product change). A calibrated system like this is able to supervise the compliance of the running production and indicate LED of bad quality at a repair station or sort them out directly. The measurement by means of a camera allows test times according to line speed.

It is also possible to use the LED test system as a mere AOI system.

The following test procedure with determination of the defined variables is carried out in different steps.

Automatic calibration by means of a photometric measurement

- light intensity
- color temperature
- light density

LED control in line speed by means of a camera (AOI)

- luminosity
- color angle
- saturation

Possibility of additional testing by means of a camera (AOI)

- examination for presence and polarity of LED and SMD components
- solder joint examination on LED and SMD components
- short-circuit test (solder bridges)

Electric functiontest

- parallel onboard programming

System integration – more than the sum of individual components

The technical requirements for modern testing technology are demanding enough – in addition, their use should reduce costs. This requires innovative systems and tools that provide extended capability with lower complexity. Principles such as traceability, close-loop, paperless repair and use of statistics for continuous improvement process have considerable effects on the productivity of companies. Here it is possible to use individual appliances with task-specific features and functions or – with regard to consistent system integration - modern testing technology is increasingly used, which ensures a convergent and universal solution.



Prüftechnik Schneider & Koch also acts as overall supplier with all components concerning handling. Integration into the existing or newly planned production environment is carried out directly by our experts at the customer's location.



Separate repair station

Test results are recorded in a result file together with date and time as well as information about the used program version and the machine number. This way, the details of a test required by the ISO standard and the product liability act are saved and traceable at any time.

The software tool **LVBoard** for localisation of faults runs at the same time as the repair software **LVRepair** and is easily usable either in combination with the **LaserVision** software or separately. On the basis of the CAD data and the circuit board image, the position of a component on the circuit board as well as the designation and the warehouse number can be displayed. Fast fault finding makes a clearly increased productivity in the area or repair possible.



Repair belt

The repair station is used for verification and repair of recognised faults. The core feature is the software **LVRepair**. On a monitor, it generates a detailed view of every fault as well as an overview image of the overall board for its fault localisation.

Continuous throughput guarantees high productivity. If a fault occurs the test system must not stand still during repair. The **LVRepair** in-line station provides a suitable solution: An intelligent circuit board buffer separates inspection and fault repair time-wise. It places faulty boards into intermediate storage and guides faulty circuit boards to the outfeed belt.

Powerful software – the road to a test program

A test program can be generated by graphically supported specification of testing steps or by means of importing CAD data. Most of the time, the assembly data of the board is used to automatically generate a test program.

LV-Cad is software available for the conversion of CAD data into the **LaserVision** format; it has extremely flexible format conversion features and can be easily adjusted to various CAD systems.

The road to the program

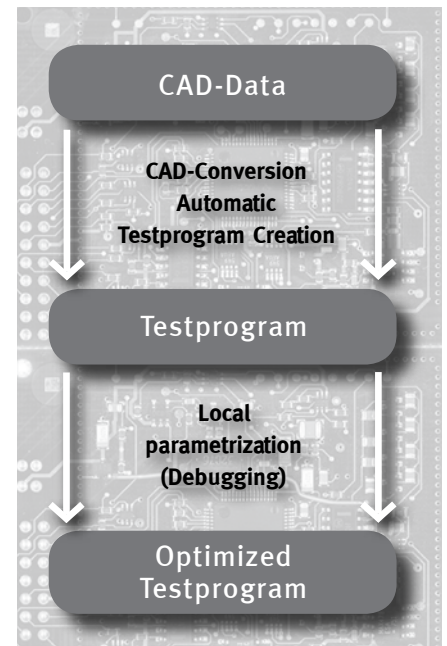
The overall test program is generated from information about type and position of the individual components and by means of the component-specific test routines. Many parameters of the individual test routines can be determined with computer-assisted methods and easily modified if necessary.

Wizard-guided entries

When generating a test program, it is very important for the user to make parameter entries as fast as possible and without mistakes. Therefore, the

system software **LVInspect** supports easy parameterisation.

The parameter windows for setup and for debugging of test programs are clearly organised with regard to content and appearances, so that the individual segments concerning component data are transparent and easy to understand for the user. As an additional help, wizard-guided entries for the few necessary parameters are available. The wizard guides the user's focus only to the entry data and to those steps that are important for the respective program segment. This reduces the chance for making mistakes while making entries considerably. Likewise, the time to master program generation is clearly reduced for the user. This way, Prüftechnik Schneider & Koch reduces the "threshold to a successful test program".

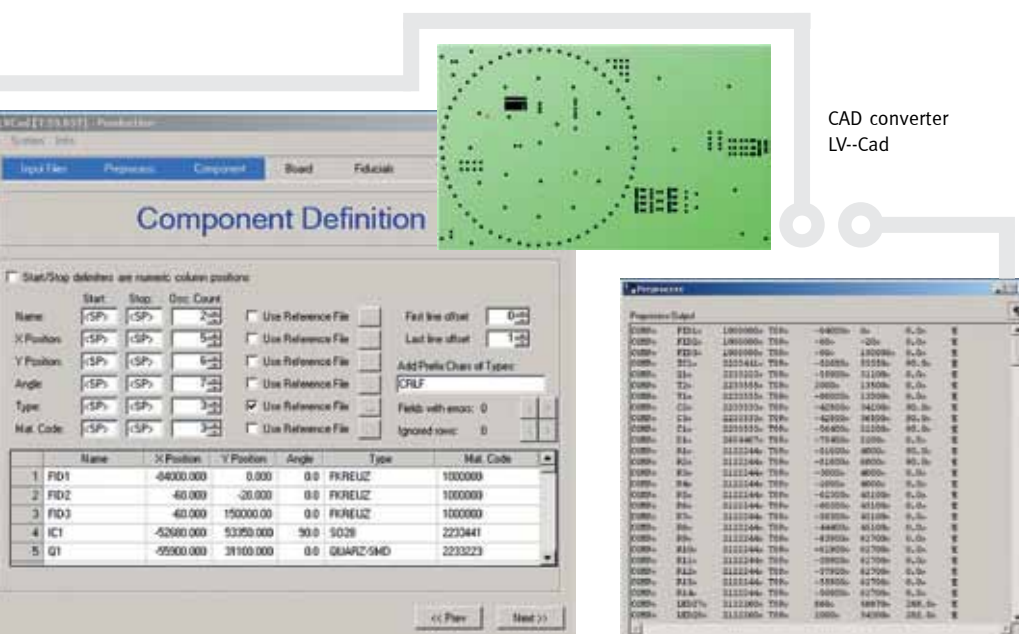


Visualisation of parameter changes

Another user-friendly feature is the graphic and self-explanatory display of those parameters currently edited by the user. The real component including the determined measurement values are visualised; in addition, a diagram indicates the relation between the real image and the parameter. Furthermore, the user has the option, to see parameter changes beforehand and context-sensitive by means of "learning function". Changes made by the user are explained to him directly and clearly by means of a diagram.

Without programming experience

LaserVision provides a limited number of standard test routines which can be used in combination to test all conventional component types. Other component tests can be compiled by the user by means of modification and combination of already existing tests.



Using component libraries, individual combinations of test routines can be generated. The test program as well as each test step can be run at any time and immediately without compilation. It is not necessary to learn a special programming language, because operation and programming of the system is fully dialogue-based.

Speed optimisation

After program generation is completed, automatic camera and path optimisation can be optionally carried out. Here, the sequence of the test steps is oriented in a way that camera selection and positions have to make the least possible changes. The result is a minimum overall runtime of the test program.

Offline programming

Offline programming provides the advantage that the majority of the overall program generation can be carried out with the optionally available offline license of the programming software on a separate PC. **LaserVision** therefore

continues to be available for circuit board inspection and is not blocked by program generation. Via remote access, production data are available, so that worldwide application support (e.g. for program generation) can be provided.

Tools for practical application

LaserVision has numerous functions that facilitate use in production of electronics. This includes examination of component and package variants, various test alternatives in the test program as well as masking of bare boards (BAD boards). Different software assistants make the programming and modification of test programmes easier. The UUT-/SUB-UUT-Wizard summarises uses with different adjustment and copies, rotates and shifts available test steps to the use. With an other assistant, the CAD-Overlay, it is possible to take over wide parts of an existing test program for new layout variations. This reduces the expenditure for new programmings significantly.

Capturing of serial numbers

Barcodes can be read by the camera or with an additional scanner and the corresponding program can be started automatically.

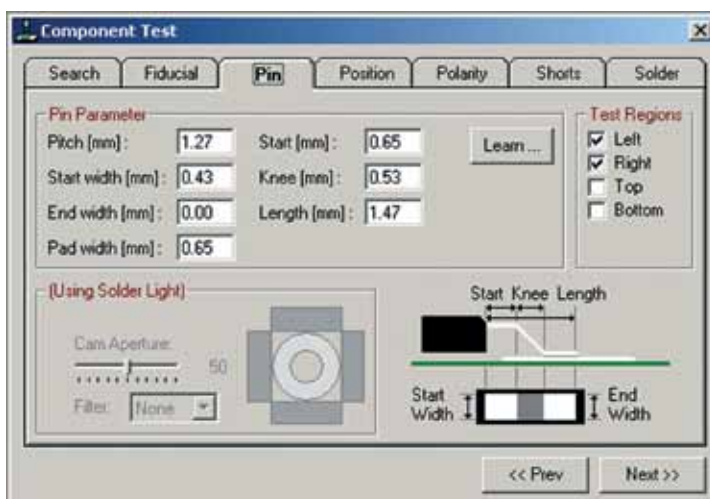
Setup verification

When a production line is set up for a new product, setup verification of the pick-and-place machine is regularly carried out before serial production starts. This is very time consuming, as the assembled board often needs to be compared manually with a sample board. **LaserVision** provides the option of computer-assisted image comparison. Testing time can this way be reduced by up to 75 percent of the time normally needed.

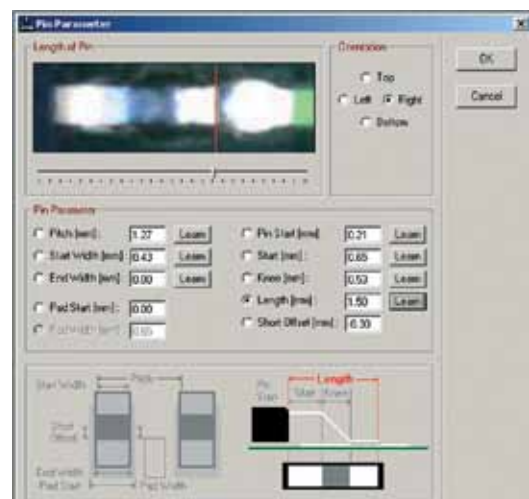
Solder paste inspection

The basis for good end products is faultless soldering paste printing. **LaserVision** checks for soldering paste and any possible defects it might have within the test area. It is position by placing a test region exactly around the pad – automatically generated from the CAD data.

Component test



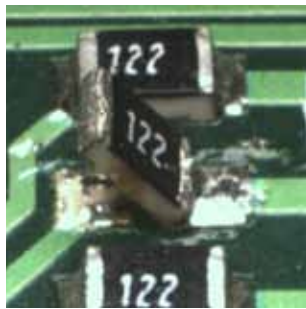
Pin parameters



Finding faults – And then what?



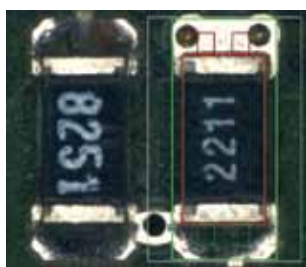
QFN with soldering defect



Tombstone



Short circuit



Soldering defect chip resistor

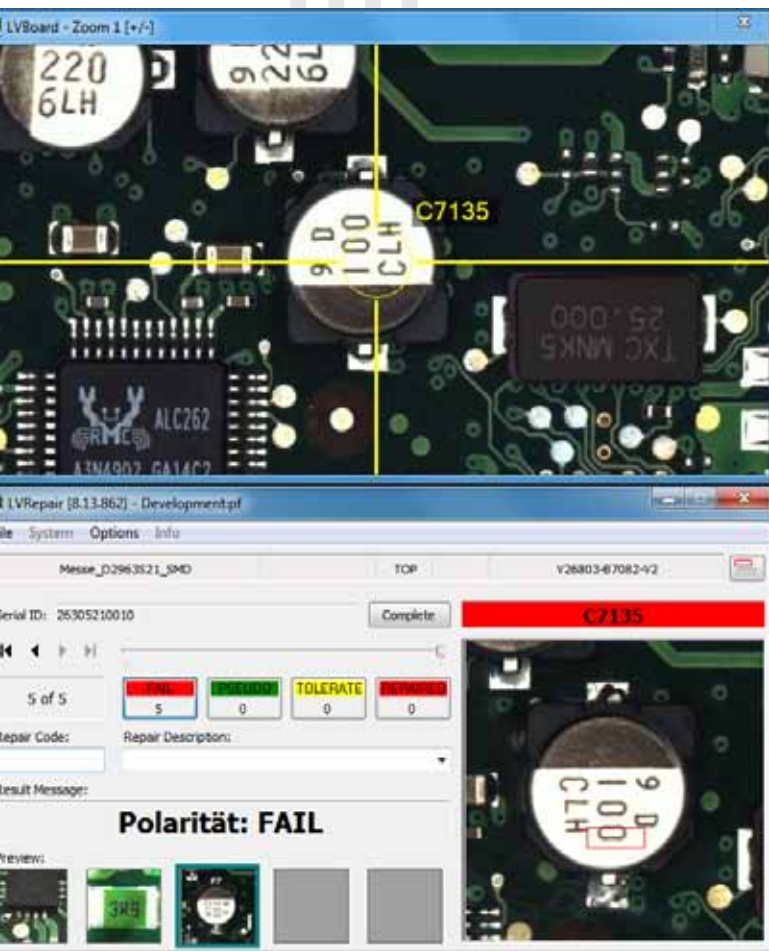
During repair, the faults identified can be classified as “true fault”, “tolerable fault”, “pseudo fault” or “repaired fault”. If there is a fault, the software **LVBoard** allows fast fault localisation.

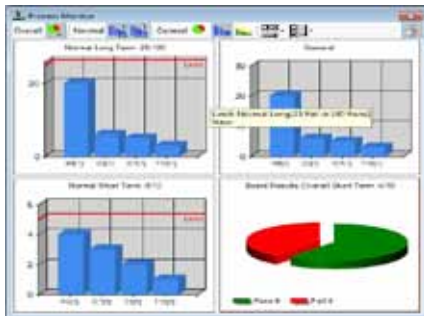
Fast fault finding

LVBoard for localisation of faults runs at the same time as the repair software **LVRepair** and is easily usable in either combination with the **LaserVision** software or separately. On the basis of the CAD data and the circuit board image, the position of a component on the circuit board as well as the designation and the warehouse number can be displayed. Fast fault finding makes a clearly increased productivity in the area or repair possible.

In addition, customer-specific repair codes and descriptions can be assigned to each fault. The fault codes and the data format can be freely configured. Furthermore, the software is also able to control a component magazine, so that the correct components are available for repair.

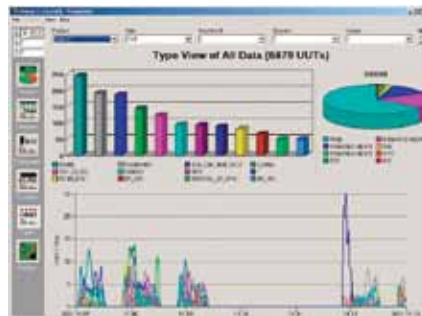
Only a coherent repair concept offers the possibility for an efficient elimination of faults.





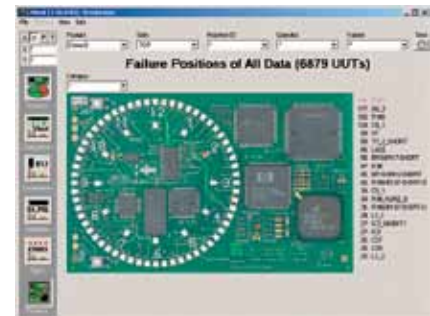
Verifying and classifying faults

The faults on the board recognised by **LaserVision** can be shown and classified by means of the software. The current fault image is enlarged and can be evaluated within a few seconds during the test. The classification subsequently allows statistical evaluation of the faults.



Fault statistics and test results

Test results are recorded in **LVStat** in a result file together with date and time as well as information about the used program version and the machine number. This way, the details of a test required by the ISO standard and the product liability act are saved and traceable at any time.



Learning from mistakes – the main objective

All collected data can be transferred to a super-ordinate quality management system in various data formats. This ensures that all information can be used for repair of the boards. Furthermore, statistical evaluation will help to recognise weak points so that processes for production can be optimised.



High safety requirements in medical technology require sophisticated test methods.





Our objective – efficient tests

Apart from modern production technologies, increasing miniaturisation of electronic components and appliances also requires efficient solutions for testing and repair. With its fault information on component level, the in-circuit test provides the necessary information for modern and economic quality assurance. Innovative test procedures such as integration of cluster tests, on-board programming as well as boundary scan supplement the classic in-circuit test.

Unique complete solution from one supplier

We offer our customers a wide range of services from generation of test programs for standard board test systems of renowned manufacturers via own test systems to adapter construction in our own company. This combination is unique; it allows the customer to use combined competences optimally.

Left: Light control units in airplanes are electrically tested by Prüftechnik Schneider & Koch – for a maximum of comfort on every trip.

Services / applications

The area of services includes full project processing in its service range. Our service often begins at the development stage of the customer project. In close cooperation, test concepts are developed on the basis of testability analysis.

Generation of applications is always based on a quotation with extensive technical description – if possible on the basis of provided CAD data. One of our competent project engineers will then begin development and debug of in-circuit, function and cluster test programs as well as installation and integration at the customer's location. In addition, the following services may be used:

- Generation of specifications, test concepts and test standards
- Training and seminars
- Generation of fixtures documentation (drill data, wiring lists, additional electronic equipment for adapter installation)
- Fixture construction at our own location
- Development of boundary scan tests
- In-circuit test models
- On-board / in-circuit programming
- Measurement system analysis (MSA)
- Incorporation into QM systems



Prüftechnik Schneider & Koch is a premium member of the Teradyne Support Network (TSN) as well as of the Rohde & Schwarz Partner Network. We are therefore officially the preferred partner for programming and adaptation of application-specific ICT test programs for test systems by Teradyne and Rohde & Schwarz.

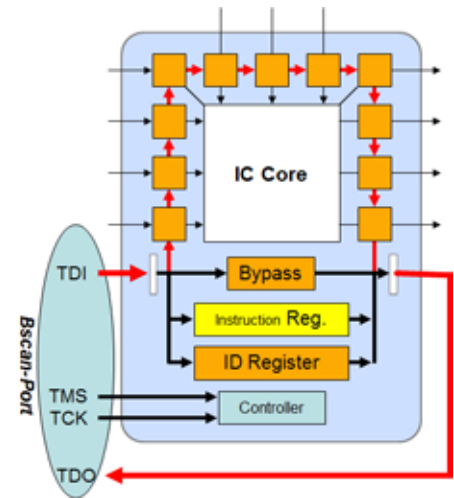
All members of these partnerships fulfil high standards in terms of quality, reliability and performance; they are regularly examined by the manufacturers.

In the area of **ATE applications**, test programs for standard board test systems are developed. The corresponding fixtures are designed and produced as customer-specific solutions. For processing, Prüftechnik Schneider & Koch uses systems by renowned manufacturers.

- Teradyne test station
- GenRad GR227x/228x
- Rohde & Schwarz TSAP/ TSVP
- Schneider & Koch Ti2GER

BoundaryScan technology is used to conduct electrical tests in the periphery of packed circuit boards. Unlike the in-circuit test, the **BoundaryScan** does not rely on physical access through a number of spring contact probes but only through four connection lines.

BoundaryScan tests only require one scannable component on the board to be tested. Circuit boards capable of boundary scan have core logic as well as an additional logic - boundary scan cells – with a so-called test access port (TAP). The boundary scan cells are integrated between core logic and the physical pins of the circuit. Through the TAP, testdata approach (TDI) and leave (TDO) the boundary cell. Boundary scan is used to identify faulty electrical components, wrong mounting, soldering faults as well as packing errors.



Why BoundaryScan?

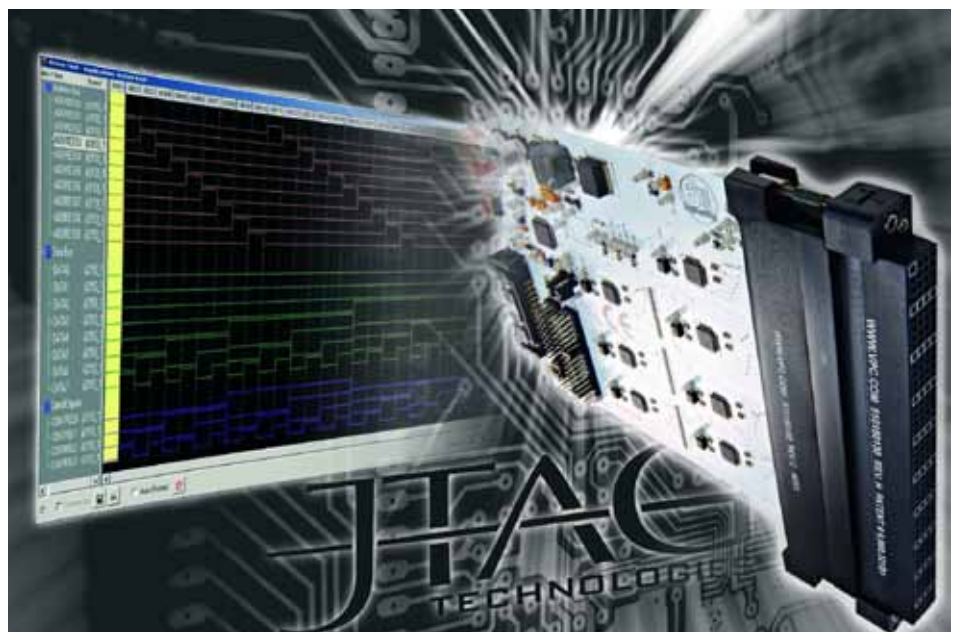
Increasing miniaturisation in the development of electronic components makes it possible to integrate more and more functions in a small space. It is therefore more and more complicated and sometimes impossible to access all nodes of the circuit for testing in order to carry out a conventional in-circuit test.

We offer:

To create test programs for standard board test systems as well as for our own systems of the **Ti2GER** family, we use development tools of renown suppliers like JTAG, Göpel and Temento. Often our customers already use these tools or they are fully integrated in their standard board test systems. In this case we can utilize the available infrastructure effectively to the customers favor. Moreover, a clear advantage of BoundaryScan compared to all other test methods is its universal applicability – from the development to the production up to the later diagnostics in the field. In this context existing BoundaryScan tests from the development can be taken over and extended to increase the test depth by using the IOs. This approach reduces the total expenditure and leads to a reduction of the one-off costs for the test program.

Examples for application of ATE:

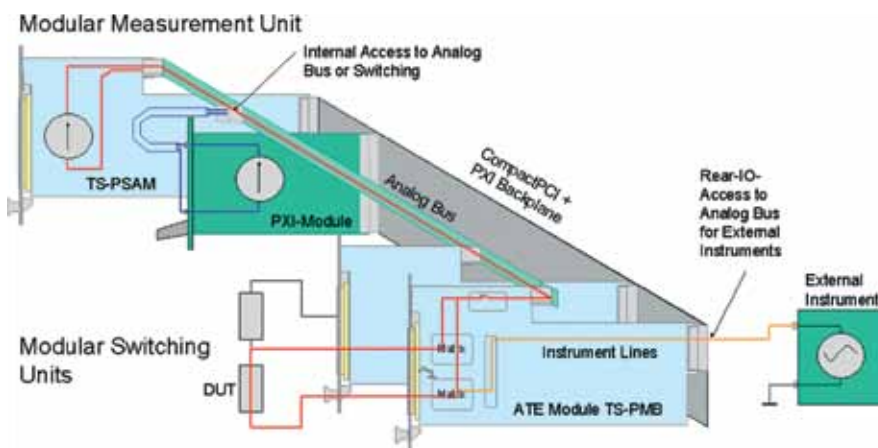
- Use of boundary scan cells for measurement or stimulus in function- / cluster-test, e.g. if no test points are available (as “silicon nails”)
- Examination of solder joints of individual components with boundary scan implementation.
- Reduction of spring probe contacts for the in-circuit test by means of boundary scan options and connector pins.
- On-Board programming



ICT-Systems – details of Ti2GERI technology

The **Ti2GER I** has been built on the industrial standard cPCI/PXI and offers the classical analogue in-circuit test as well as the flexibility to integrate an active test including function test.

The core components of an in-circuit tester are measurement technology and a multi-pole multiplexer with a suitable analog bus system for connecting the specimen networks on the measurement technology. The basic system of the **Ti2GER I** provides max. 900 pins distributed on 10 card modules. Using an extension rack, it is possible to realise a pin availability of up to 2,250 pins. Using the analog 8-pole measurement bus in connection with the card modules, signals with up to 125 VDC can be connected without signal conditioning.



ICT measurement technology

All the measurement technology in the system is operated via galvanically separated individual supply systems. This allows real potential-free stimuli and measurements. The following basic data are offered by in-circuit measurement technology:

- Contact test
- Short-circuit test
- Connection test
- Resistors (0.1 Ω – 10 M Ω)
- Capacitors (10 pF – 10 mF)
- Inductivities (25 μ H – 100 H)
- Diodes (0.1 μ A – 100 mA, 0-5 VDC*)
- Discharge (10 mA – 450 mA)

* In connection with the optional PSU-modul Z diodes with a voltage up to 100 VDC can be tested.

The measurement frequency for impedance tests can be optionally programmed to 100 Hz, 1 KHz or 10 KHz. The switching matrix in combination with the analogue measurement bus allows simple 2-wire measurements as well as 3-, 4- and 6-wire measure-

ments. This way, measurements with analog guarding can be realised. This forms the basis for achieving reliable and reproducible measurement results in a switching system at component level.

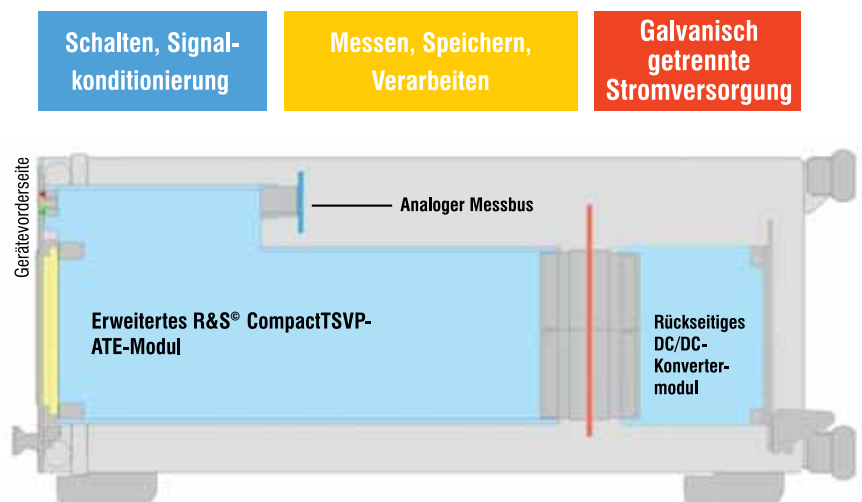
Universal application

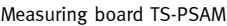
The measurement system can also be used in function testing. Here, the extensive measurement functions of the ICT measurement unit for various test requirements are used.

- Measurement VDC (10 mV – 125 V)
- Measurement IDC (1 μ A – 1 A)
- Measurement VAC (20 mV – 90 V)
- Measurement IAC (100 μ A – 1 A)
- 4 quadrants potential-free DC source $\pm$ 5 V, max. 100 mA
- 16 bit-ADC at 200 ksamples/s
- 8 k memory for recording of signal patterns

cPCI / PXI architecture

The open system standard with the bus technology cPCI/PXI provides the user with the option to design the system flexibly using cPCI and PXI plug-in boards that are available on the market.





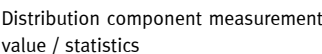
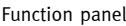
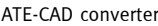
The in-circuit test software **RS-EGTSL** offers the user all the necessary tools for debugging of the in-circuit test programs. All parameters for measurement are clearly shown. Every change can be instantly implemented and tested by a mouse click.

The self test program testing the functions of the modules and measurement unit is included in the scope of delivery. The self test program has integrated error messages which facilitate system diagnosis and fault localisation and that provide hints for possible fault causes. Execution of self tests does not require a self test fixture.

There are two possibilities for regular calibration of the test equipment and measurement devices used: On the one hand, calibration can be carried out in approved calibration laboratories. To do this, the appliances must be dismantled and shipped. Therefore, it is preferable to have calibration carried out on site – especially in order to exclude production downtimes or the necessity for maintaining backup equipment. For this second option, calibration is carried out by an external calibration service or by means of on-site calibration hardware. The hardware can be optionally integrated in the realisation of the test system.

In-circuit test programs are generated by means of a program generator (ATG). The input data are the CAD data imported via the software package **ATE-CAD**.

Apart from the in-circuit test program, the program generator also generates the wiring list for the test fixture. Alternatively, the program can be generated manually. For debugging of the fixture, the wiring can be additionally adopted via pin probe.



ICT test fixtures – design and production

Independent of the test procedures used, the basic condition for economic and successful testing of PCBs is reliable contacting of the circuit boards. As a specialist for test technology and customer-specific test systems, Prüftechnik Schneider & Koch is a competent partner also for adapter construction.

In the course of managing complete test projects and as a service, Prüftechnik Schneider & Koch has designed, produced and developed test fixtures for more than 30 years. A number of adapters of various construction types are available for a wide range of test system types and applications: From one-, two-stage or dual side vacuum fixtures

via various manual fixtures to in-line fixtures and individual special fixtures.

Continuous further developments in terms of fixture construction ensure modern and reliable adaptation even for difficult testing problems.

Prüftechnik Schneider & Koch has partnerships with ...



Various fixture types:

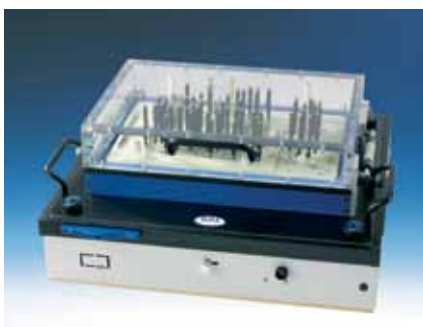
- Vacuum fixtures – one-stage, two-stage, dual-side
- Manual fixtures – plug-in fixtures, cable afixtures, pneumatic fixtures, change fixtures
- In-line fixtures – one-stage, two-stage, dual-side
- Special fixtures – for instance rotary disc fixtures or HF fixtures



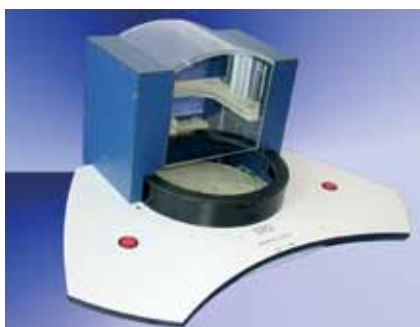
HF fixture



Pneumatic fixture with change cassettes



Vacuum fixture with hood and downholder



Rotary disc fixture



Exchange cassette system

The offer of complete solutions for the area of electrical fixturing makes it possible to provide services that exceed fixture construction. For instance, test fixtures are fully verified. In addition, data processing and generation of the wiring data can be offered as a service.

Often, weak points or faults are already discovered at the construction stage; their identification generates synergy effects. As a result, already existing solutions such as test models or special test hardware can be included.

Engineering results in synergies

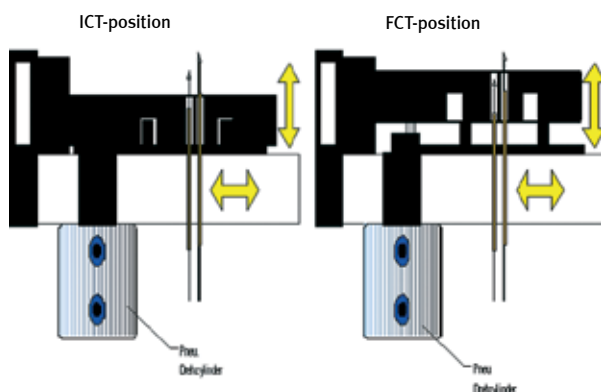
The user has extensively tested solutions at his disposal in order to decrease development time, which plays an important role from the perspective of cost-benefit considerations.

Fixture structure is always specific for the specimen and may include:

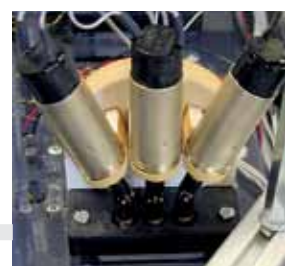
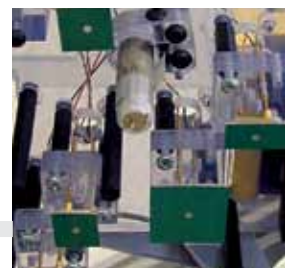
- Hoods and downholders
- Vacuum seals
- Side and plug contacting
- Integration of board markers, tuning screwdrivers, barcode scanners, operation of buttons and switches, LED and display test
- Fitting of special measurement technology (OpensXpress/FrameScan)
- Construction of additional electronic systems (customer-specific or standard boards)



Prüftechnik Schneider & Koch produce reliable test fixtures in its own factory.



Two-stage execution of the fixture to separate all unused needles for critical measurements without having to remove the UUT from the fixture

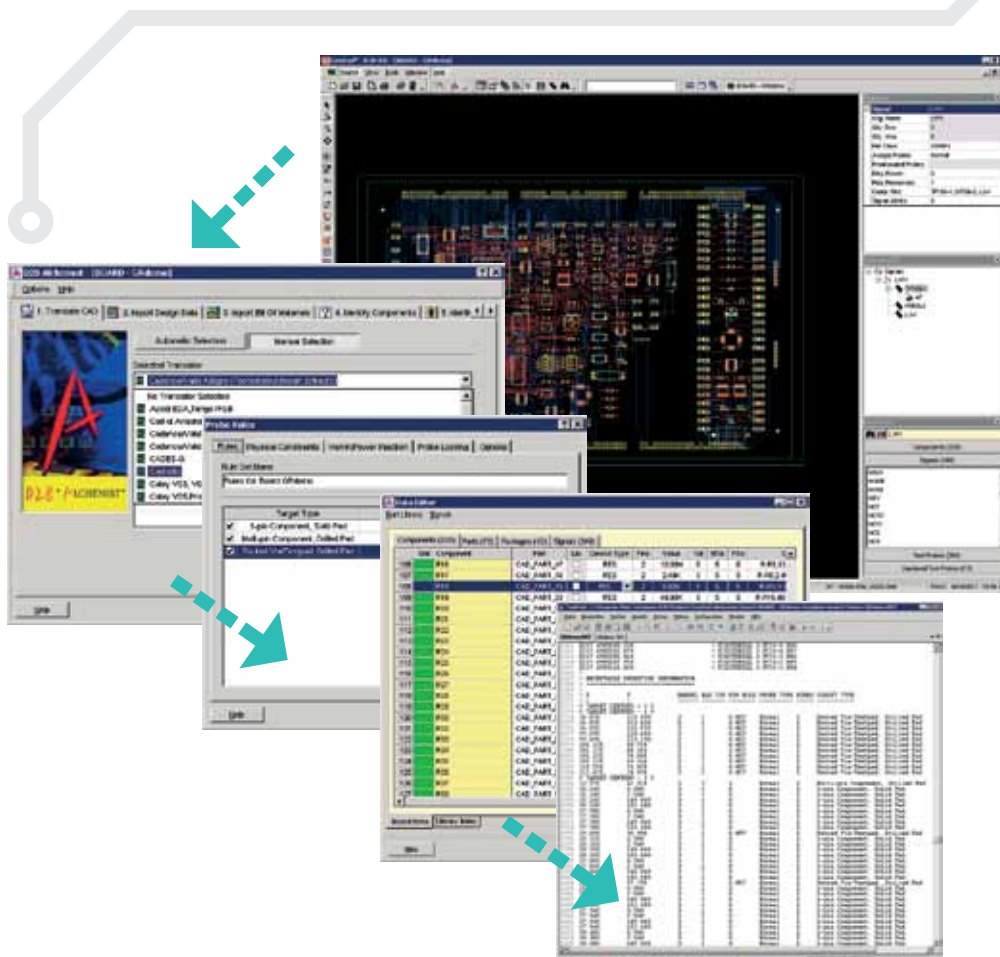
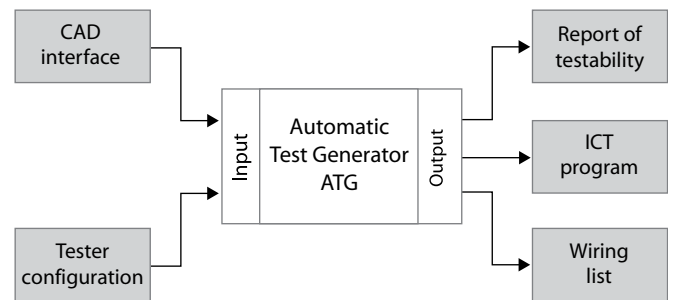


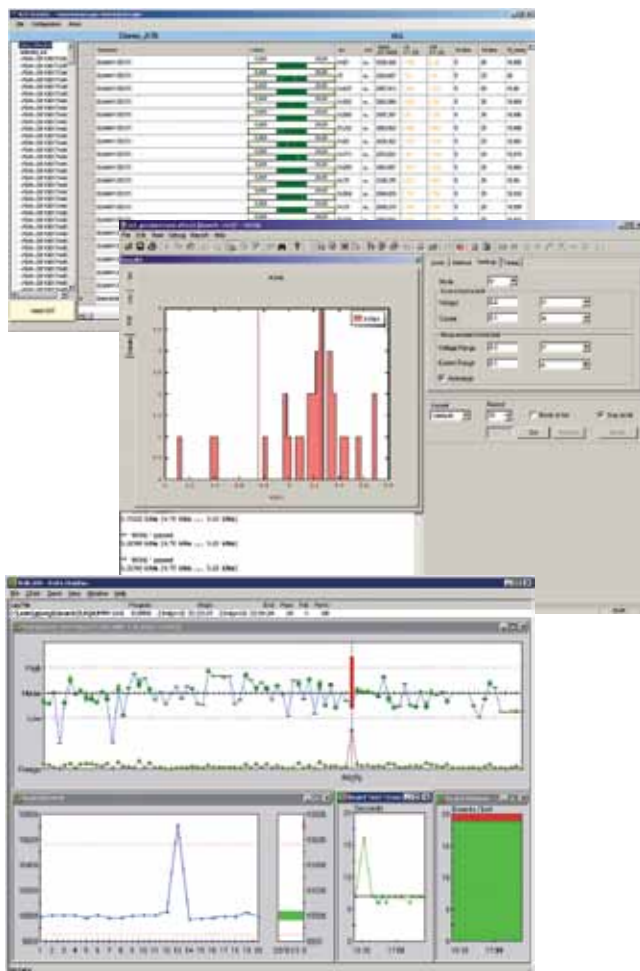
Software - for solution-oriented test systems

Apart from execution software, effective conduction of in-circuit tests also require software tools for input data processing and tools for data compression and quality verification of the test programs.

ATE-CAD is a modern and flexible tool to convert CAD data into a specific format for further processing in the area of in-circuit test systems which makes it possible that almost any CAD format can be loaded. In the area of CAD data conversion, data are often converted manually. The reason is often the high acquisition cost and the complexity of the software for conversion of data. When developing **ATE-CAD**, it was therefore ensured that the solution was cost-efficient and user-friendly.

Apart from conversion of the data for the in-circuit test, the necessary data records can also be generated for the repair station **ATE-Repair**.





Statistical evaluations

Highest quality standard of the test programs

All test programs by Prüftechnik Schneider & Koch are tested in an internal acceptance procedure for stability and reproducibility. For each measurement, the user receives an overview of measurement values, mean values, unit, and standard deviation as well as the parameters cp and cpk. Based on these data, the programmer can optimise his measurements, so as to receive precise tests with the necessary reproducible exactness.

These analyses can be used for release of new applications as well as for subsequent examination of the process parameters. It is therefore possible to check whether any deviations from the test data received so far have occurred after alternative component suppliers were used. Borderline conditions, otherwise undiscovered, can be detected this way.

Complex high-frequency (HF) components used in civil or military sender and receiving technology are to be tested for faultlessness







Our offer – customer-oriented solutions

A function test is used to test the functionality of packed circuit boards and systems. This may be carried out between individual production steps or as test at the end of the production process. Function tests are becoming more and more important in modern production of electronic equipment. The main reason for this is that the ratio of in-circuit test is declining due to limited contactability and an increasing number of customer-specific ICs.

Depending on quality requirements for the delivery, function, complexity and component design, function tests must be designed individually.

More than conventional testing

In addition to optical test procedures, electrical function test systems fulfil these requirements. We offer customer-specific as well as universally usable function test solutions.

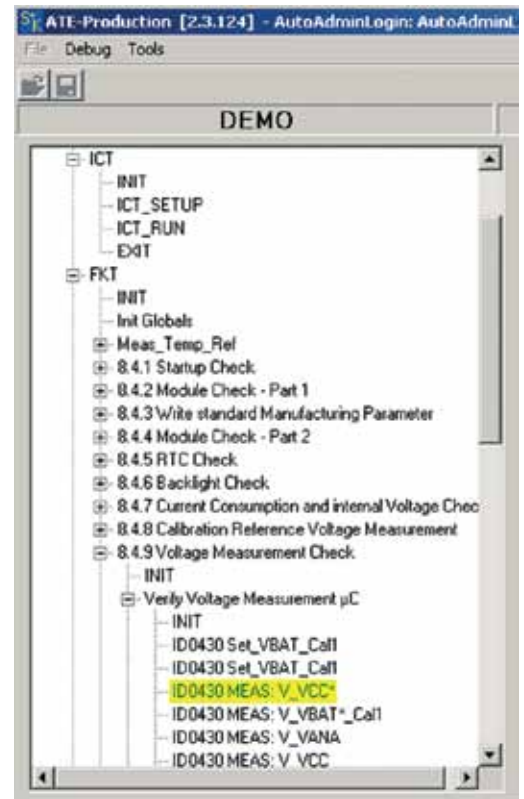
Left: Automotive technology requires reliable function tests in order to eliminate sources of error at all production stages.

Services and applications

With growing complexity and shrinking time slots for time-to-market, efficient program generation in the area of function tests is gaining importance. Preparation and execution may be time-consuming; it requires the test engineer to thoroughly understand the most various requirements and at the same time to master the technologies used. In the area of test services / applications, our experienced specialists are available for these tasks for a wide range of industries.

Apart from application for existing customer systems, it is often also necessary to develop a complete test system. Here the requirements of the test itself as well as the production parameters such as test time, handling and traceability must be considered for implementation.

A test specification is basis for every function test; it defines the test procedure precisely. Generation of a test specification, often in combination with test analysis down to FMEA is our daily business.



ATE-Production tree structure

System production at Prüftechnik Schneider & Koch.



The efficiency of test systems and their specific integration into the local requirements is decisive for the economic success. Ideally design and development of customer-specific test devices are therefore provided by one supplier. In the company division measurement and test technology, development and production of customer-specific test devices for production of large and small series, as individual or in-line solution, are made on the basis of the **Ti2GER test system family**. Our know-how includes the most varied technologies and procedures of electronics, image processing, mechanics and pneumatics in order to apply them precisely and combine them as necessary.

The objective is to achieve technically and economically optimal solutions, which make high production safety possible. For instance, test devices are used for quality assurance in the form of an optical or electronic appliance end test or for optical measurement of mechanical parts. At the customer's request, testing is often integrated into the production environment, e.g. incorporation into the PLC or QM systems.

Solutions for individual requirements

The variety of options in measurement and test technology covers a wide range of applications specific for each industry. For automotive, telecommunication, industrial electronics, power electronics, medical technology, military technology as well as aviation and space travel Prüftechnik Schneider & Koch is the solution provider for individual requirements.

Various system variations for setting up a test device are available to the user. Generally, it is always possible to select the **Ti2GER** system without system integration. This way, the user can integrate the modules into his individual test environment, e.g. an existing in-line contacting cell or a laboratory table.

Combination of options

Depending on the requirement, the **Ti2GER** system family provides solutions in the form of **Ti2GER I**, **Ti2GER F** and **Ti2GER C** systems. **Ti2GER I** provides the customer with a powerful analogue in-circuit test with up to 2,250 pins. As for all **Ti2GER** systems, easy programming, high test speed, self-test programs and self-calibration tools are part of the basic version. The **Ti2GER F** is based on the function test system **Ti2CA**; with more than 100 different plug-in boards, it can be configured very flexible for the most various requirements with functionally testing PCBs. The **Ti2GER C** is a combination of all options; it unites the advantages of analogue in-circuit test with those of a functional test.

Innovative swivel function

The **Ti2GER system** makes ergonomic installation of the test workstation possible because the whole test system can be swivelled. The test head can be adjusted in a way that the adapter can even reach a horizontal position. This way, incorporation into in-line contacting cells is possible.

Ti2GER:

Ti2CA

Increases your
Gain and
Efficiency
Rating



Flexible exchange fixture with adjustable rack-frame receiver

INVESTMENT PROTECTION

The modular structure of the **Ti2GER** test system family safeguards your investment, because the systems configuration as well as structure can be adjusted to new requirements.

Function test systems – examples for the variety of customer-specific possibilities



Building services

The products to be tested are often produced in numerous variants. These modules from the area of building services are equipped with display, camera, keys and bus system. The modules are fully end-tested, including optical test (camera and display) as well as an acoustic test. The interface for electrical adaptation is designed for universal mounting of specimen of various types. Fast change of the products to be tested – circuit boards as well as end appliances – is possible. The adaptation is also characterised by particular interference resistance which is ensured by the special **DCC system (Draw-Close-Connect-System)** by Prüftechnik Schneider & Koch.

Industrial electronics – function test in a rotary machine

In the PC-based test system with test electronics, based on RS232 and PC plug-in boards, a full function test and optical examination of the components is carried out. The component to be tested is mounted on a rotary table that has 8 positions. In function test position, the component is contacted with spring contact probes and inspected optically in further stages. Before the component is automatically and carefully stored in a “pass” or “fail” box, the “pass” components are mechanically marked. The system is controlled via a light curtain for handling optimisation.



Automotive test system for end test

The components to be examined are trigger sensor systems for roll bars in upmarket convertibles. The DUT are adapted in a mobile mounting device. In mounting, possible overturning situations are simulated and DUT behaviour is calculated. The measurement and control system was designed on the basis of PXI components.





Industrial electronics – high voltage and function test

In the PC-based test system with PXI/cPCI measurement electronics, a high voltage test as well as a downstream function test is carried out. Adaptation is made via spring contact probes in drawers designed as dual mounts. Since the overall measurement electronics must be insulated against high voltage, the S&K high voltage matrix is used. This way, the high voltage test can be conducted with up to 2.500 V DC.

Telecommunication test

The test system is realised on the basis of a PXI/cPCI Chassis CTSVP by Rohde & Schwarz. The test procedure fully covers the electrical test as well as testing of speakers, display and microphones. The modularity of the system makes extension by an in-circuit test (ICT) possible. Additional hardware completes the functionality for special tests according to the telecommunication standard ETSI.



Power electronics – RUN-IN test system

The specimens used in ground conveyors heat up due to their own power; they are tested in the corresponding test cabins actively RUN-IN. The specimen mounts are equipped with high-current contact probes. In the overall system, currents of up to 400 A DC are switched. The PC-based test system permits communication use of de-centralised measurement electronics via a CAN bus. Testing is carried out in parallel mode.

FCT adaptations – design and production

In the scope of contract production of test fixtures and as a service with own test program development, test adapters of the most varied type are build for different test system types.

In design and production of test fixtures, we construct for various different systems. This covers construction of complete vacuum fixtures, special contact systems and downholder constructions as well as production of specimen-specific seals. In FCT fixture construction the additional requirement is to realise not only conventional contacting systems of circuit boards, but also sometimes complicated adaptations of complete appliances with housing. The quality of the fixture is an important condition for economic and reliable testing. Special requirements must be fulfilled by FCT fixtures particularly in the area of HF, high current and high voltage.

In addition to fixture construction, test programs are developed and tested on our own test systems in order to offer optimised, customer-oriented solutions.

Various fixture types:

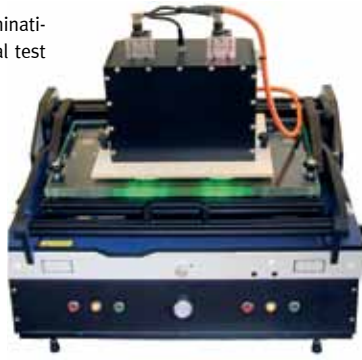
- **Vacuum fixtures** – one-stage, two-stage, dual-side
- **Manual fixtures** – plug-in fixtures, cable fixtures, pneumatic fixtures, change fixtures
- **In-line fixtures** – one-stage, two-stage, dual-side
- **Special fixtures** – for instance rotary disc adapters or HF adapters



Pneumatic push fingers operate the keys of the specimen during the test.



FCT fixture with integrated cameras for examination of displays as part of the functional test



According to the CAD data and the specifications of our customers, work preparation and fixture construction is carried out by using 3D CAD software. Subsequent use of cutting edge CNC machines for production and equipment of the fixtures provide our fixtures with extraordinary precision in order to be able to ensure reliable and safe contacting at any time.



Adaptation as exchange unit with lever mechanics

Fixture construction includes incorporation of CAD data of the specimen as well as any environment of the specimen (e.g. in case of housings). As we incorporate the environment of the specimen at an early time, we are able to achieve seamless fitting of what is to be the specimen. Using cutting edge hard and software it is possible to generate documentation in various output formats, which is particularly important with regard to archiving, maintenance and for adjustment requirements.



Fixture production at Prüftechnik Schneider & Koch



Function test system with rotary disc adapter:
In the PC-based test system a full function test and optical examination of the components is carried out. The component to be tested is mounted on a rotary indexing table that has 8 positions.

FCT software – ATE-Production

As test system software, **ATE-Production** provides all functions necessary for electrical testing in a modern production system.

With **ATE-Production**, Prüftechnik Schneider & Koch provides a powerful process control for test programs. This way, complex processes for various requirements such as in-circuit test, functional test, end test or combined test can be realised. Furthermore, execution of panel tests is implemented.

Customer-specific interfaces

For use in production, **ATE-Production** provides the option to use customer-specific interfaces for the operator. Alternatively, a standard production

interface is available for all necessary input and output for the test procedure.

No programming experience required

ATE-Production does not require source code manipulation for programming. On the interface it is directly possible to generate a complete test program in a short time without programming experience. In addition, existing software modules such as drivers of modern platforms such as National Instruments Lab-View, Lab-Windows / CVI or .net can be incorporated.

The test system software supports programmers as well as operators in production.

After realisation of the test program, **ATE-Production** upon request will automatically generate a full documentation of settings, parameters, tolerances, options and variants existing in the test program. The documentation is issued in RTF format and can therefore be loaded into all conventional text processing programs. Apart from test computer and test program, all test steps can be proven and traced this way at any time.

This is a particular advantage for the user in terms of obligation to archive and produce proof in the scope of ISO certification as well as with regard to acceptance criteria for the customer.

ATE-Production

Board image representation

Development interface

Production interface

Repair station interface ATE-Repair

Statistics interface ATE-Stat

Various additional modules are available for **ATE-Production** in order to facilitate integration and use in production and development. These are control functions for in-line integration, measurement and evaluation functions as well as measurement system analysis (MSA).

The software module **ATE-Stat** provides the programmer with all the information necessary to assess the quality of his measurements. For each measurement, the programmer receives an overview of measurement values, mean values, unit, and standard deviation as well as the parameters cp and cpk. Based on these data, the programmer can optimise his measurements, so as to receive precise tests with the necessary reproducible exactness.

In addition it is possible to apply special filters directly from the user interface of **ATE-Stat**, for instance to carry out specific evaluations for serial testing. This applies in particular for defined periods or barcode areas as well as for statistical value for individual boards. Furthermore, an export function facilitates use and further processing of the measurement values in any type of spreadsheet program.

Efficient repair

The repair station software **ATE-Repair** completes the software package. **ATE-Repair** provides the operator with all the necessary information for economic trouble shooting and repair. The input port for test and repair data can be easily adjusted to various formats. Therefore **ATE-Repair** can also be used in combination with test systems from the area of ICT or flying probe.

The repair station software ATE-Repair provides:

- Display of repair data as well as information about faults, measurement values, target values and tolerances
- Display of the repair history of the component
- Display of OK test values
- Input of repair information for history and statistics
- Board image with LVBoard
- Display of electric circuit plans

The automotive area includes a number of human-machine interfaces that are examined for operability and function.





Service – test and repair

In the company division »test services« we have been carrying out fault diagnoses, repairs and confirmation tests of packed componentboards for renowned companies for years; for any requirements we develop individually adjusted solutions.

The tests are carried out on test systems with cutting edge test technologies including required test program generation and adaptation. Particularly for manufacturing service providers in safety-relevant areas such as medical technology, traffic engineering or industrial electronics, automatic test installations are nowadays indispensable in order to meet the customers' high quality standards.

Profile of performance

- Flying probe test for small series and samples
- Automatic optical inspection (AOI)
- High voltage test
- In-circuit test
- Function test
- On-board / in-circuit programming
- Boundary scan test

Advantages

- Low budget strain
- Coverage of capacity peaks
- Testing of exotic specimen
- No commitment of capital or personnel
- Planning safety
- Exact test cost allocation
- Cost-effective alternative to in-house testing system

Electronic components for solar-thermal collectors and photovoltaic systems are tested on the basis of extensive criteria.



Consulting – using competences

Based on long-standing project experience in test technology, we support our customers with consulting in order to guide them decisively and target-oriented to success. Customers now have a higher expectation with regard to performance and quality of consultants. They demand fast results that recognisably advance their companies.

In cooperation with the customer, Prüftechnik Schneider & Koch generates test concepts including all services from the area of »Design for Testability«. If requested, complete projects including project management – from development to serial launch of a new product – are carried out.

Provider of complex solutions

The definition of the test contents and of the necessary test installations as well as implementation are consistently monitored and carried out orientation to results. In addition, we offer training and seminars.

Passenger conveyors and escalators have customer-specific electronic drive and control components that must be tested consistently.



Your worldwide contact partners
are listed at: www.prueftechnik-sk.de



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“Measurable increase of product quality and assurance of your business success due to reliable and innovative solutions.”

Andreas Menge & Ronald Block,
Managing directors
Prüftechnik Schneider & Koch

Reference customers





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You've got a real partner.