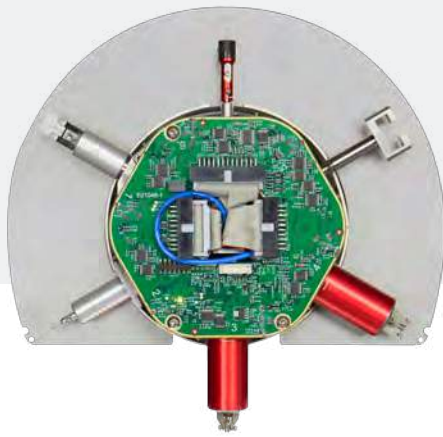# Sigma

Rock solid bond testers with game-changing automation capabilities

No more cartridge exchanges

The Revolving Measurement Unit (RMU) houses up to 6 flexible sensors that are configurable with various pull, peel, push, or shear tools. This enables continuous testing up to 200 kgf.

A pleasure to set up
- Revolving Measurement Unit (RMU)
- Easy to learn software
- Deep access capability
- Quick release work holders
- Software has Easy and Expert modes

Flexible onboard analysis
- Statistical Process Control (SPC)
- Control chart (cpk, graph, et cetera)
- Unique form features for SPC management
- Real-time force graphs
- Define control rules

Most accurate bond tester
- Unparalleled 0.075% accuracy
- 30 nm linear encoders
- Digital temperature correction
- Programmable landing force down to 5 gf
- 24 bit ADC resolution

Modular by design
- Various loading options
- Fits your sample too
- Powerful camera options
- Compatible with your existing work holders
- Flexible export and SECS/GEM

Sigma

Worldwide service
- Market leader
- Offices all around the world
- Extensive network of distributors and representatives
- Spare parts locally available
- Consumables webshop

Best in class ergonomics
- Designed with the operator in mind
- Adjustable microscope without losing focus
- Clean working environment
- Debris management
- 2x6 button joysticks

Full automation

Loading
Robotic handlers
Easy programming

Testing
Smart vision cameras
Tool alignment
Fiducials recognition
Wire detection

Analyzing
Grading run
Auto grading
Image measurement (AOI)
Data communication

Sigma

Most advanced bond tester

Sigma Lite

Lowest cost of ownership

Sigma W12

Waferlevel 2" - 12"

Sigma MAG

Handler for magazines

Sigma HF/L

High force or large area

Sigma EFEM

Handler for wafers and panels

Sigma

Advanced bond tester

Proven Sigma performance

Sigma is the most advanced bond tester. It comes with game-changing automation capabilities and high specifications in:

- Sensor accuracy and resolution
- Large X stage
- Superior axis speed
- Cameras and illumination
- Future proof and modular design

Sigma Lite

The Sigma Lite is a low cost of ownership bond tester that grows with your company. It offers a low-cost entry point by giving up some of the above Sigma features. It is possible to upgrade to a full Sigma later.

Automation

A Sigma is modular by design and comes with full automation capabilities. The Revolving Measurement Unit (RMU) houses up to 6 sensors that enables continuous testing. The software includes vision and deep learning technology to eliminate human errors.
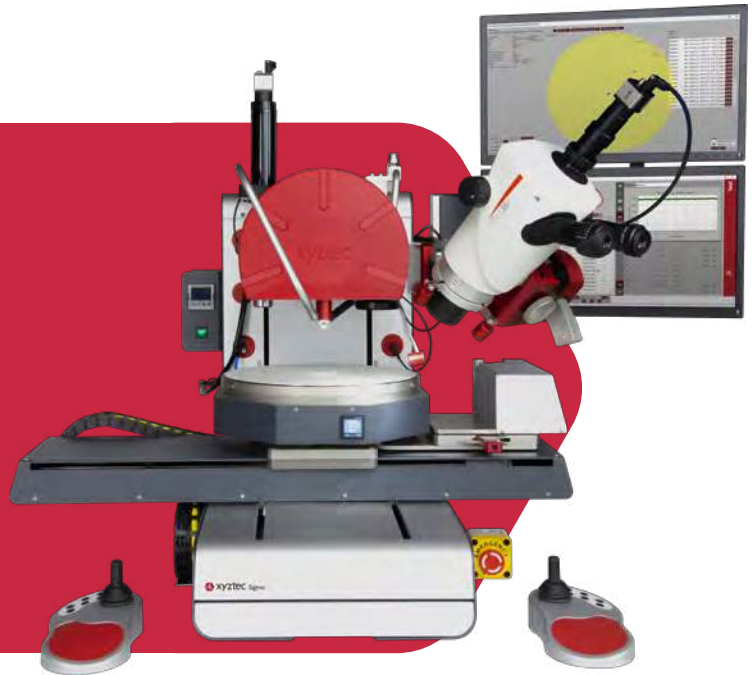
Single test heads

You can also equip the Sigma with single heads for shear (SMU) or for Push and Pull (PMU). All test heads come with the same specifications as the RMU in terms of maximum forces and accuracy. There is no need to readjust the microscope when you do switch cartridges. They all share the same test point.

Sigma W12

Wafer bond tester

Bond tester for wafers 2 - 12 inch

- Wafers or at wafer level 2" - 12" (up to 300 mm)
- Precise testing and Cold Bump Pull (CBP) testing
- Large X/Y stages X: 600mm, Y: 370 mm
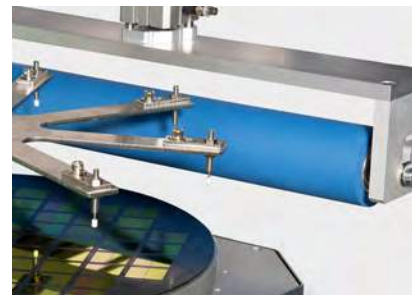- Force range from 1 gf - 10 kgf
- Bump pitch down to 20 μm

Panel chuck work holder

Vacuum work holder for panels or wafers up to 300 mm. Easily reach 100% of a 300 mm panel without repositioning your sample on the chuck.
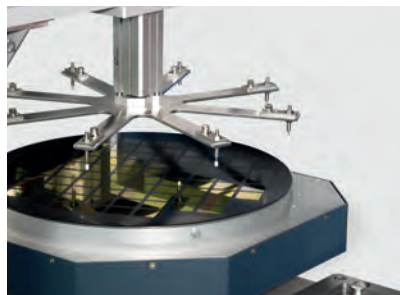
Wafer pusher

In cases of extreme warpage, an optional wafer pusher ensures precise clamping.

Wafer cleaning unit

Keep test debris away from the wafer or the wafer chuck with a blower and vacuum cleaner or a roller with sticky foil, for pre- and post-cleaning.

Sigma MAG

Magazine handler

Automated lead frame testing

The Sigma MAG comes with an independent lead frame (un)loader for hands-free bond testing. The handler is compatible with OHT and AGV and allows top and front-loading of multiple types of:

- Lead frames
- Cassettes
- Magazines
- PCBs
- Flex
- Boat carriers

Sigma MAG

Slot and device selection

Matrix programming allows you to test a variety of position types, including repeating positions, like:

- ◗ Rows and columns
- ◗ Specific or randomized locations
- ◗ Predefined test location from remote protocols driven by SECS/GEM functionality, and more!

Automatic width adjustment

Because of its extended 600 mm X stage, the Sigma MAG can accommodate lead frames up to 100x240 mm. To ensure fast, simple, and repeatable changeovers, you can use automatic width adjustment.

Waffle tray loader

Automated waffle tray loading (pick and place)

Quickly test whole waffle trays of samples without operator intervention. You can program a waffle tray loader on your Sigma MAG to pick the sample from the waffle tray and place it into the clamper and vice versa.

Sigma HF/L

High Force Large area

World's most powerful bond testers

- Typically for IGBT, power modules and batteries up to 1000 kgf
- High axis speed
- Deep access up to 80 mm
- SEMI S2 safety cabinet with visual feedback
- Flexible positioning of multiple work holders

360° Head design

Easy positioning and programming are possible with up to 5 cameras on a 360° rotational measurement head. These head-mounted cameras come without tool-to-camera offset.

Options

- Extra-large stage for even larger test volume
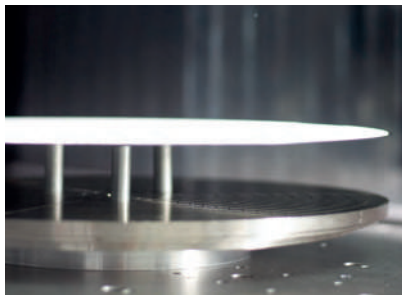- Revolving Measurement Unit (RMU)
- Customization

Sigma EFEM

Wafer/panel handler

Chosen by the world's top 4 semiconductor packaging houses

Integration transforms the bond tester into a fully automated system. We offer various types of wafer and panel handlers (Equipment Front End Module), for operator-free bond testing.


Intelligent lift pins

The system gently secures flat and warped wafers with the soft, flexible tips on the PID controlled wafer lift pins.
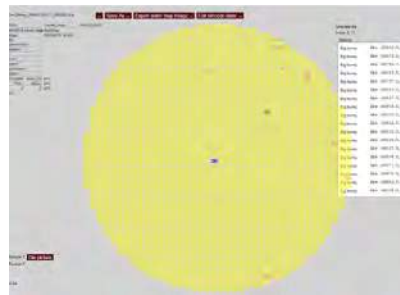
Substrate wafer map import

Easily import and export multiple file formats for wafer maps such as KLARF, (S)INF, G85, and others for full traceability. Defects or test positions are shown in an overview and are directly accessible for testing or analysis.
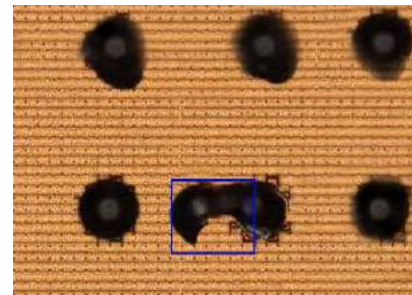
Big bump removal

Automatically shear the big bumps and clean the debris to prepare for wafer probing. Fully programmable vision algorithms can check if the removal of big bumps was successful.

Safety Cabinet

Sigma MAG

For SEMI S2, combine a Sigma with a safety cabinet

This option guarantees extra safety during automatic bond testing and protects the operator from moving parts. The cabinet fulfills the standards for safety and ergonomics, and it keeps the test debris away to ensure a clean working environment.

- Stable lighting for camera stability, because of semi-transparent covers, which block ambient light
- Mobile user interface for free positioning over the full cabinet length
- Joysticks, keyboard, and mouse are always accessible in a transparent protected and extractable drawer
- Optional automatic loading from AGV or OHT
- CE and TÜV certified

Customization

High temperature bond testing

Heated stage

Warm up your samples to high temperatures to test epoxied or soldered interconnections. Especially useful for shear testing on large rectangular glass carriers.

Full protection

The (hot) panels are easy to handle by using the sample carrier and cooling down rack. Triple heat shielding around the test head makes sure that the prolonged high temperatures do not affect the inner working of the Sigma bond tester.

Quick and uniform warm-up

An extremely flat aluminum table delivers a perfect vacuum. With 27 heater elements in 7 different control groups, the Sigma quickly warms up its table and the sample with high accuracy and consistency.

Battery modules

Work holder for heavy applications

Easily test heavy applications such as battery packs using custom work holders and extra support on a Sigma platform. The quick clamping solution allows for easy and repeatable positioning of a battery pack module. We offer bond test systems for all battery pack sizes, including bench-top and floor model solutions.

Your sample fits, too!

Stages

High-speed bond testing maximizes your units per hour (UPH). The standard Sigma* comes with a high axis speed of 50 mm/s, direct-drive motor, and mapped linear positional encoders to ensure very accurate positioning.

Floor-based Sigmas come with high speed axis of 500 mm/s and 10 nm encoders.

Work holders

- Accurate alignment
- Perfect clamping solutions
- Quick release

Secure lock maintains reproducible positioning
Easy to change with quick release handles
Exchanging workholders is a very fast procedure
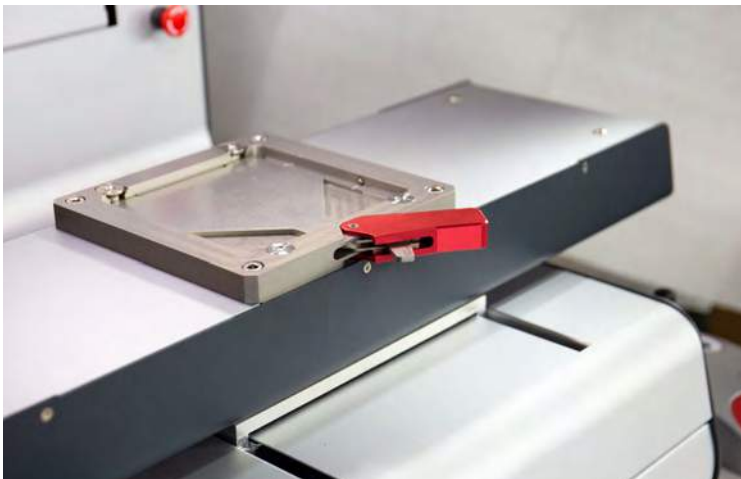
Besides customization, we have a wide selection work holders available.

Revolving Measurement Unit (RMU)

House up to 6 sensors

Forget about exchanging your tools or load cell cartridges. The RMU rotates to the correct sensor in seconds. Up to 6 sensors are available at one time to test continuously to a maximum load up to 200 kgf.

6-in-1 test head

No more exchanging cartridges. Flexible sensor configuration for pull/push and shear

Tweezer

House up to 6 tweezers of any type, USB, pneumatical and/or mechanical

10 gf - 200 kgf

Force range for push, pull and shear sensors

Easy to use

No warm up time and no risk of sensor damage

Ports

USB connectivity, as well as vacuum and air

Accurate sensors

Exceptional 0.075% accuracy and world's highest resolution of 24 bits

Tools

Shear (push)
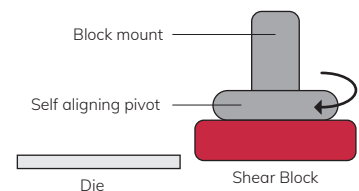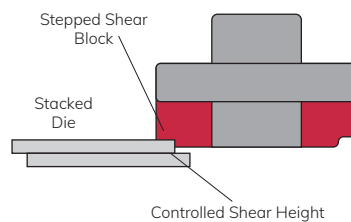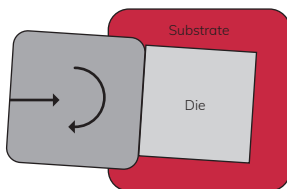

Wire hooks (pull/peel)

These and other tools for scratch, hardness, lead fatigue, stud pull, calibration tool, ribbon pull, cut tool. Besides a wide range of standard test tools, we design custom solutions to fulfill all test requirements.

Self-aligning shear tool

A patented tool to shear large or stacked dies, as the strength of the bond is in proportion to the area of the die, but the area available to apply the shear load is limited.

A vacuum mount holds a soft material shear block in place and rotates slightly (self-alignment). Surface irregularities between the edge of the die and the tooltip result in multiple smaller points of contact. The soft material of the shear block deforms at these points. This deformation considerably reduces the high contact stresses that would cause the die to fail.

Substrate

Die

Stepped Shear Block

Stacked Die

Controlled Shear Height

Block mount

Self aligning pivot

Die

Shear Block

Tweezers

Working with extremely small bonds requires a high level of accuracy. With xyztec USB tweezers, you can fully control the gripping force and the opening and closing position.

The gripping jaws (tweezers with tips) are driven by a built-in closed loop 3-phase brushless microdrive to accurately open or close. The jaw actuators incorporate a strain gauge to precisely measure and control the gripping force. Besides a range of standard tips, we design custom tips to suit many different applications. You can house up to 6 different tweezers in the RMU.

Electric (USB)

- Programmable and traceable opening position and closing force
- Programmable landing force
- Programmable force maintain

Mechanical

- Forces up to 100 kgf
- For special applications

Pneumatic

- Opening with air
- Controlable by software

ELECTRIC (USB) TWEEZERS	
Maximum clamping force (kgf)	7
Adjustable clamping force (kgf)	0-7
Average closing time (sec)	1
Adjustable LED brightness (%)	0-100
Rotation stroke (°)	±90
Maximum opening stroke (mm)	1.2
Easy exchange of tips	Yes

MECHANICAL AND PNEUMATIC	
Maximum clamping force (kgf)	100
Adjustable clamping force (kgf)	50
Rotation stroke (°)	±90
Maximum opening stroke (mm)	3

Please contact us for more information and options for your factory. Specifications are subject to change without prior notice.

CBP Jaw Cleaner

The solder that builds up in the cavity of the Cold Bump Pull (CBP) jaw reduces the gripping efficiency. This contactless cavity cleaner melts the solder with a high temperature and high-pressure air jet and then blows it into a fine matrix where it is absorbed.

Automation

Wafer/panel handler EFEM

Combine a Sigma W12 wafer bond tester with various Equipment Front End Module (EFEM) platforms for operator free wafer/panel (un)loading and testing of wafers up to 300 mm.

Pick and place loader for waffle trays

With a waffle tray loader on a Sigma MAG, you can easily pick samples from the waffle tray and place samples into the work holder and vice versa.
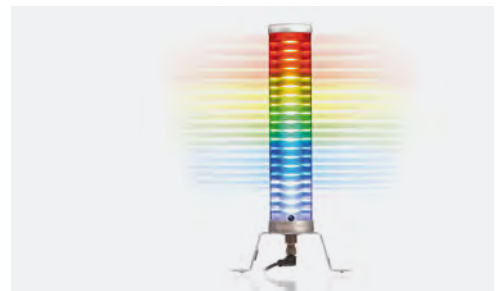

Magazine loader for lead frames

Add an independent lead frame (un)loader for hands-free bond testing of multiple types of lead frames, cassettes, magazines, PCBs, flex, and boat carriers.

Visual feedback

Programmable stack lights allow you to work efficiently and to manage multiple systems simultaneously.

Loading · Testing · Analyzing

Robotic handlers · Easy programming · Smart vision cameras · Tool alignment · Fiducials recognition · Wire detection · Grading run · Auto grading · Image measurement (AOI) · Data communication

Automation

Easy programming

The open Sigma software enables easy programming of total automation steps, positions, and commands. The automation editor employs camera visualization and intelligent wizards.

Other optional solutions to minimize human errors:

- **Barcode reader**
  Quickly start a test sequence using a 2D barcode reader. An automation, test method, or form starts automatically after scanning the QR code or barcode.
- **Matrix selection**
- **Substrate map import**

Smart vision

See the unseen with up to 3 live cameras. Bring out the features of interest with images or video using high-resolution cameras, flexible LED illumination, and fantastic image processing options. Well shot images can be the input for automatic grading.

Downward looking camera

- Image capturing
- Position recognitions (fiducials and wires)
- Failure modes analysis and grading

Side view camera

- Secondary viewpoint
- Tool alignment

Trinocular camera

- Live video images
- Tool alignment

Loading   Testing   Analyzing

Robotic handlers | Easy programming | Smart vision cameras | Tool alignment | Fiducials recognition | Wire detection | Grading run | Auto grading | Image measurement (AOI) | Data communication

Automation

Tool alignment

- **Self-aligning shear tool**
  A tool to correct the smallest angular differences between the tool and the sample, thereby avoiding point contacts.
- **Deep access**
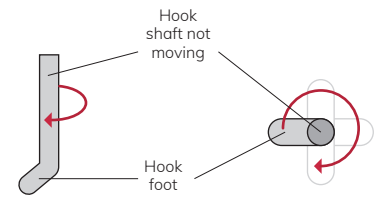 Tooling and flexible cameras to test complex sample architecture.
- **Revolving Measurement Unit**
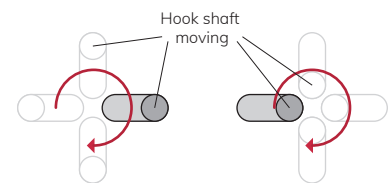 Switch between different tools in seconds with our 6-in-1 test head (RMU).
- **Concentricity correction**
  Achieve tool eccentricities less than 5 μm.

☑ **Concentric**

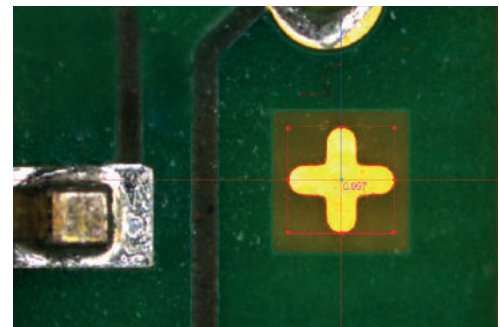Hook shaft not moving

Hook foot

☒ **Not concentric**

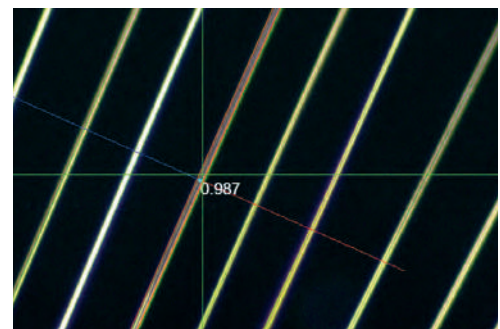Hook shaft moving

Fiducial recognition

Define recognizable shapes, patterns, or marks as a global or local reference for positioning and automatic alignment.

Wire detection

Recognition of components and fine pitch wires that are swept out of position due to process tolerances or part handling.

Loading	Testing	Analyzing

Robotic handlers · Easy programming · Smart vision cameras · Tool alignment · Fiducials recognition · Wire detection · Grading run · Auto grading · Image measurement (AOI) · Data communication

Automation

Auto grading

Many leading manufacturers automatically grade the failure modes of the test result images. For ball shear, smart optical inspection algorithms calculate the percentage of the remaining bond material in the region of interest and identify the failure mode using classifications. You can also automatically grade other types of bond failures.

Operators do not need to fulfill assessments by accepting or editing the failure modes at the end of an automation run. With deep learning and the advanced Halcon library, we train a neural network to do the image processing for you. By classifying the failure mode criteria beforehand, image recognition is ready to perform automatic grading without any assistance.

Grading run

Traditionally, operators do the grading after each test. The Sigma offers two alternatives to make this process more efficient and consistent.

1. The operator does all the gradings in one step after a sequence of tests, using the microscope or an offset camera.
2. A Sigma can take it one step further and make automatic determinations of the failure modes (auto grading).
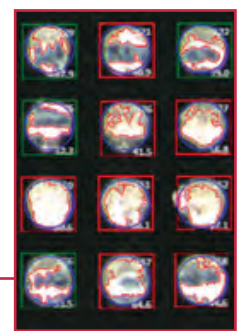
Loading · Testing · Analyzing

Robotic handlers · Easy programming · Smart vision cameras · Tool alignment · Fiducials recognition · Wire detection · Grading run · Auto grading · Image measurement (AOI) · Data communication

Automation

Image measurement

Detailed optical inspection helps you to perform image measurements or to identify the failure modes of the captured test results.

Quickly measure manually in captured images by drawing lines or shapes (rectangles, ellipses) and measure:

- Distances
- Lengths
- Widths
- Heights
- Areas

Automated Optical Inspection (AOI)

For more advanced image processing, filtering, segmentation, and detection of shapes, you can use Automated Optical Inspection (AOI). AOI allows you to examine test results and to measure features between objects, and angles.

Open	Pict.	Exp...	Snc.		Seq.	Dis.	Angle [°]	Area [µm²]
🔒		🖶		4815	4	📊	-81.4	2528752.8
🔒		🖶		4815	3	📊	-78.1	2539446.5

Loading   **Testing**   **Analyzing**

Robotic handlers · Easy programming · Smart vision cameras · Tool alignment · Fiducials recognition · Wire detection · Grading run · Auto grading · Image measurement (AOI) · Data communication
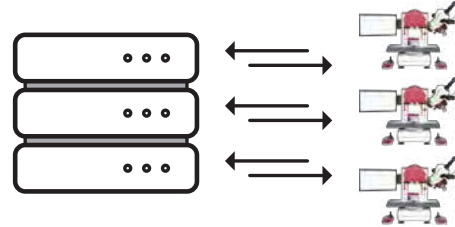
Automation

Data communication

Automatically store the reports after several measurements. The editor supports export to file, serial port, clipboard, and other protocols such as SECS/GEM.

Share between systems

- SQL based system
- Share all setups and data among machines
- Centralized back up
- Storage capacity
- Historical information records
- Data integrity

SECS/GEM

SECS/GEM is an equipment interface protocol for equipment-to-host data communications in the semiconductor industry. Several xyztec customers use the bi-directional SECS/GEM capability of the Sigma for test results, images, recipes, and other data.

Loading | Testing | Analyzing

Robotic handlers · Easy programming · Smart vision cameras · Tool alignment · Fiducials recognition · Wire detection · Grading run · Auto grading · Image measurement (AOI) · Data communication

Applications

PULL	PUSH	PEEL	SHEAR	MEASUREMENT	OTHER
Cold bump pull (CBP)	Ball on ring	Adhesives	Cavity shear	Auto grading	Cantilever beam
Copper pillar pull	Bending	Film	Copper pillar shear	Loop height	Cantilever bend
Lid pull	Connector	Ribbon peel	Copper tab/conductor shear	Optical	Creep
Ribbon pull	Keypad		Die shear	Probe	Deep access
SMD component pull			Gold/copper ball shear		Fatigue
SMD gull wing pull			Overhanging die shear		Lead integrity/micro torsion
Stud (die) pull			Passivation layer shear		Lid torque
Tweezer pull			Ribbon shear		Scratch/coating
Vector pull			Solder ball shear		Spring rigidity
Wire pull			SMD component shear		
			Total ball shear/zone shear		
			Wedge shear		

Your operators will love it

We design with the operator in mind

We believe happy operators are essential for efficient and consistent results during bond testing. The Sigma was designed with the operator in mind from day one.

The Revolving Measurement Unit (RMU) is not only an excellent enabler for automation. It is also ideal for manual testing. The RMU switches between up to 6 different tools and sensors within seconds, without risk of cartridge damages.

Best in class ergonomics

The Sigma joysticks offer easy control for XYZ manipulation, tool rotation, and to move the stages. The 12 buttons allow control of all vital software functions without the need for the operator to look away from the microscope. The microscope mount is designed to easily adapt to different height operators, and it easily swings out of the way for complete access to your work.

Easy programming

Our completely open multilingual software comes with 2 levels of programming, for operators and engineers. The Easy Mode is simple to learn and very intuitive. Advanced users choose the Expert Mode, which opens up all flexibility, including customization of test sequences, scriptable test methods, and extensive data extraction.

Easy to use

Manual users benefit from small automation features:
- Automatic hook rotation between wires
- Integration of barcode readers
- Extensive built-in SPC functionality
- Quick-release work holders and our vast experience designing clamping solutions

Specifications

	SIGMA LITE	SIGMA	SIGMA W12	SIGMA MAG	SIGMA L	SIGMA HF
FORCE SENSORS						
Revolving Measurement Unit (RMU) max. 6 sensors up to (kgf)	100	200	10	200	200	🔴
Single Measurement Unit (SMU) 1 sensor up to (kgf)	100	200	10	200	200	1000
STAGES	SIGMA LITE	SIGMA	SIGMA W12	SIGMA MAG	SIGMA L	SIGMA HF
X-stage (mm)	168	370	500	600	500	500
Y-stage (mm)	168	168	370	168	500	500
Z-stage (mm)	168	168	90	168	200	200
Axis speed (mm/s)	5	50	50	50	500	500
Resolution linear encoders (backlash free drives) (nm)	30	30	30	30	10	10
Digital temperature correction	🟢	🟢	🟢	🟢	🟢	🟢
ACCURACY						
Accuracy (%)	0.2	0.075	0.075	0.075	0.075	1
ADC resolution (bit)	16	24	24	24	24	24
Sampling frequency (kHz)	2	10	10	10	10	10
Shear height (step back) accuracy ±1 μm	🟢	🟢	🟢	🟢	🟢	🟢
Programmable landing force down to 5 gf	🟢	🟢	🟢	🟢	🟢	🔴
1° sensor rotation resolution	🟢	🟢	🟢	🟢	🟢	🟢
Tool rotation accuracy ±10 μm (including software down to ±5 μm)	🟢	🟢	🟢	🟢	🟢	🟢
ACCESSORIES						
High resolution cameras	3	3	3	3	3	🔴
Head mounted cameras (no tool-camera-offset)	🔴	🔴	🔴	🔴	🔴	5
Ergonomic SEMI S2 safety cabinet	🔴	⚪	⚪	⚪	🟢	🟢
Blower and vacuum tool cleaning unit	⚪	⚪	⚪	⚪	⚪	⚪
CBP Jaw Cleaner (contactless)	⚪	⚪	⚪	⚪	⚪	🔴
SOFTWARE						
Supports Microsoft Windows	🟢	🟢	🟢	🟢	🟢	🟢
Easy to learn intuitive graphical user interface	🟢	🟢	🟢	🟢	🟢	🟢
Minimum number of mouse clicks	🟢	🟢	🟢	🟢	🟢	🟢
Customizable screens	🟢	🟢	🟢	🟢	🟢	🟢
Integrated report editor and data export	🟢	🟢	🟢	🟢	🟢	🟢
Easy data sorting, grouping and filtering	🟢	🟢	🟢	🟢	🟢	🟢
Integrated SPC and system GR&R analysis	🟢	🟢	🟢	🟢	🟢	🟢
Multiple languages, multiple user network environment	🟢	🟢	🟢	🟢	🟢	🟢
Export to XLS, DOC, PPT, PDF, XPS, CSV, XML, DBF, KLARF, INF, et cetera	🟢	🟢	🟢	🟢	🟢	🟢
SECS/GEM*	⚪	⚪	⚪	⚪	⚪	⚪
SERVICES						
Correlation with other bond testers	🟢	🟢	🟢	🟢	🟢	🟢
Ergonomic layout to SEMI S8	🟢	🟢	🟢	🟢	🟢	🟢
CE + EMC compliant	🟢	🟢	🟢	🟢	🟢	🟢
ISO9001, ISO13485 and ISO14001 certified production	🟢	🟢	🟢	🟢	🟢	🟢
Calibration jigs and weights (OIMI class M1 or NIST class 1)	⚪	⚪	⚪	⚪	⚪	⚪
1 Phase 100-240VAC 1+N+PE 45-64Hz 5A	🟢	🟢	🟢	🟢	🟢	🟢
3 Phase 207-528VAC 3+N+PE 50-60Hz 8A	🔴	🔴	🔴	🔴	🟢	🟢
Compressed air required	🔴	🔴	🔴	🟢	🔴	🟢
MECHANICAL						
Footprint X (mm)	620	620	1300	1800	1200	1200
Footprint Y (mm)	558	558	935	900	1200	1200
Height (mm)	608	608	608	1100	2500	2500
Weight (± kg)	80	80	100	160	1350	1350

Please contact us for more information and options for your factory. Specifications are subject to change without prior notice.

🟢 Standard
⚪ Optional
🔴 Not available

xyztec

xyztec

With over 20 years of experience, we have established our name as the technology leader in bond testing throughout the world. With 100% of our focus on bond testing, xyztec teams with customers to offer innovative solutions that address their specific bond test needs. Our mission is to take on the challenges of many different industries by offering customers products that improve their quality and increase their bottom line.

We believe that our Sigma systems embody the competencies, accuracy, and knowledge of each of our staff members. Each Sigma is modular by design and equipped with the latest technology available. The manufacturing takes place in close cooperation with our ISO9001 certified Dutch suppliers. At xyztec bv, we have the experience and teamnology to create solutions for any bond testing requirement. Our skilled engineers, based all around the world, work together with global partners to provide local support worldwide.

Sigma

Our system product's name, Sigma, comes from the Greek letter "σ" which is used in statistics as a representation of standard deviation. In business applications, Sigma relates to processes that operate efficiently and produce items of the highest quality by minimizing process variability.

A Sigma bond tester is the best the market has to offer. It is rock solid and comes with game-changing automation capabilities to test the mechanical strength of bonds with unparalleled precision. With a Sigma, you can improve your process and, therefore, the quality of your final product.

Patents

- ◗ Challenging traditional approaches, xyztec's dedicated R&D team has developed many innovative technologies that provide a variety of ways to improve bond testing. We own granted patents in several territories. Amoung these are:
- ◗ Digital creep and drift correction
- ◗ Improvements to high force die shear tooling
- ◗ Solder cleaning system
- ◗ A method for determining a strength of a bond and/or a material as well as a bond tester apparatus
- ◗ Improvement to step back height

Xyztec is a member of the Simac family. Simac, founded in 1971, is a technology company that employs around 1250 people across Europe, realising over 250 million euro turnover per year."

xyztec bv

The Netherlands (HQ)
J.F. Kennedylaan 14b
5981 XC
Panningen
The Netherlands
+31 77 306 09 20

Germany
Schäferei 18
06237
Leuna
Germany
+49 346 38 66 66 90

USA
33 South Main St.
Unit #1, PO box 2189
Wolfeboro, NH 03894
United States
+1 978 880 2598

Asia Pacific
72/7 M.12
Soi. Soonthornwipak
Bangpla, Bangphli,
10540 Samut Prakan
Thailand
+66 86 520 94 58

Taiwan
No. 157, Zhongzheng
6th St., Hukou
Township, Hsinchu
County 303,
Taiwan (R.O.C.)
+866 911 258 295

China
Room 2012 Haichuang
Mansion, No.288
Dengyun Road,
High-tech district,
Kunshan, Jiang Su, China
+86 186 26 24 17 11

info@xyztec.com

www.xyztec.com