SAM 400

Scanning Acoustic Microscope (SAM)

General Specification Document

Rev 1.1

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PREFACE

This document is intended to provide a general specification for the PVA TEPLA ANALYTICAL SYSTEMS GMBH SAM 400 Scanning Acoustic Microscope.

This document is intended to be distributed with documentation of all of the tools subsystems, the facilities specification, service manual, applications manual and training guide.

PVA TEPLA ANALYTICAL SYSTEMS GMBH may make changes to specifications and product descriptions at any time, without notice.

REVISION HISTORY

March 18, 2011 initial release of document

SAM 400 SPECIFICATION SUMMARY AND SYSTEM DESCRIPTION

System rf-bandwidth 500 MHz

High performance pulser receiver interface with 500 MHz bandwidth

High frequency, high power, digital pulser/ receiver with 500 MHz bandwidth for use with ultrasonic transducers up to 400 MHz. All transducer parameters are digitally selected by the reference files. The receiver has 95db of gain for maximum penetration into absorbing samples. The gain is digitally selectable in precision 1db steps for quantitative materials characterization. The pulser provides a 14 dB advantage for frequencies up to 50 MHz and a 10 dB advantage for frequencies higher than 100 MHz (options) over competitive SAM systems, allowing deeper penetration into samples for the same transducer frequency or the use of higher frequency transducers for better resolution at the same depth within a sample. Signal filters (option) are available to compensate noise and increase the SAM resolution and the signal to noise ratio.

Integrated ADC board (analogue digital converter)

A single or dual channel version, A-scan waveform display and capture interface for digital oscilloscope data & archiving, displaying the actual regions being gated for imaging with several scanning modes.

Unique acoustic auto focus system

Patent protected feature (patent **DE102006005449A1**, acoustic auto focus 2005), auto focus mode related to sample surface or interfaces of interest.

Scanning modes:

A-Scan:
Local time of flight information, cursor mode to reference an A-scan with each pixel position in the image in real-time and user selectable A-scans to be store with every image. **Cursor mode** to reference a A scan with each pixel position in the image in real time and user selectable A scans to be stored with every pixel.

B-Scan:
B-Scan analysis mode for virtual cross-sections. This allows operator to simply select a line(s) of cross-section or to isolate the features located within a particular range of depth.

C-Scan:
Imaging of selected gated echos.

X-Scan:
Precision gating of echoes with selectable step sizes for narrow layer-by-layer sample depth analysis.

G-Scan:
Application specific X scan, precision gating of echoes with selectable step sizes for narrow layer-by-layer sample depth analysis, gain, focus position e.g. can be selected for every sliced image.

D-Scan:
Virtual cross section scans from sample top to bottom

P-Scan:
Array of B-scans, free selectable

Auto–scan:
Automatically selection to pre-programmed location(s), selects field of view, magnification, auto focus, auto selections of gate parameters and gains for virtually automatic inspection of the samples.

Sequence scan:
Automated scans of pre-defined areas and gated image positions, including auto focus. Applications Setup Wizard-assists users in setting up sequences, instrument parameters, transducers settings, required transducer position, gate setting and others are included,

Z-Scan:
Tomography image acquisition with digital reconstruction for virtual volumetric viewing with 3-D profiling & non-destructive cross sectioning, acquisition of the entire time of flight information for for each x;y pixel. Offline analysis of all scanning modes on a separate PC possible (additional WINSAM dongle required).

Tray scan:

Automated scans of pre-defined areas, including auto focus. The tray matrix is free programmable, useful for automated selctions of IC`s or wafer in a tray matrix.

HOLES file scan (option):
Detection of 3 D depth informations in a dedicated developed “holes” file algorithm. The 3 D information can be displayed using a special developed holes analyzer software.

Through Scan (option):
A second through scan transducer for simultaneous C-Scan/through-scan imaging.

Scanning system:

The scanner utilizes a 2 axis digital linear motor drive system with opto mag encoders and virtually elimination of vibration by inertial balancing of the scanner. By eliminating vibration and sample motion during the scan very narrow and precise layers of the sample can be isolated, gated and analyzed. The inertial balanced scan also provides the fastest image acquisition times available at the market today.

High performance high speed 2 axis (x;y) linear motion scanning system
Encoder resolution 15 nm
Trigger interface , encoder interface, X; Y; z motor controller unit

Scanning range: 200 µm x 200 µm-420mm x 420 mm
Z axis: patent protected auto focus system, z=100 mm, motorized

Maximum scanning speed: 1.500 mm/sec
Recommended scanning speed: 1.000 mm/sec
Maximum scanner acceleration: 12.000 mm/sec²
Recommended scanner acceleration: 9.000 mm/sec

Scanning modes: high quality scan, meander scan, fast pre scans (selectable)

Sample tank version 1: 670 mm x 870 mm x 70 mm
Sample tank version 2: 670 mm x 870 mm x 150mm

Imaging modes:

Negative, positive or bi-polar peak imaging, selectable thresholds for surface trigger, data gates
Mean imaging
Time of flight imaging
Phase inversion imaging (delamination detection)
Surface bending image mode (war page)

Surface trigger stabilization

Graphical User Interface WINSAM 5.8

The functionality of the C-SAM is controlled by an advanced intuitive graphical user interface and control program WINSAM 5.8 utilizing a Windows® 7 platform. Easy to learn and broad enough to be used for a variety of tasks ranging from detailed analysis to automated inspection routines.

Main features:

Variable gain, gate width and gate delay setting during scanning
Threshold selectable, positive-negative peak phase detection: amplitude, mean, bipolar
Phase measurement with automatic delamination detection (selectable)
Length measurement, time of flight measurements, war page measurements
Automatic storage and recal of instrument setup parameters with every image saved in “sam” format. All C-SAM parameters and settings are recalled and reset automatically, allowing the system to perform a new analysis under identical conditions as the previous image by simply opening and loading a stored image.
Automatic scan size set-up by drawing a window over the area of interest. This creates a full pixel resolution image of the area of interest.
Zoom and panning of image to magnify area of interest.
Three-Dimensional (3-D) Amplitude projection of acoustic amplitude data
Acoustic impedance mapping provides the most accurate method determining acoustic impedance and polarity (e.g. bond/ dis bond evaluation).

Flexible image resolution:
Scanning resolution (pixel): 125x125, 250x250, 500x500, 1.000x1.000, 2.000x2.000, 4.000x4.000, 8.000x8.000, 16.000x16.000, 20.000x20.000, , any other resolution possible (change of scan resolution base), configuration in Winsam software.
Fast Mode: scanning with interpolation in y of 1,2 or 4 lines: that means: 500x250 or 500x125 or 500x64 resolutions
(applicable to x=125, 250, 1.000, 2.000, 4.000, 8.000 for faster data acquisition)
High quality scan, meander scan
Colour coding (free selectable)
Delamination detection in percent (%) of selected area
Image export in BMP, jpeg and SAM formats
Operator mode, expert mode, service access by writing and editing of several log files

Computer control:

High performance PC workstation, 3 GHz Processor
Dual Core
4GB RAM
HDD (RAID 1 configuration)
DVD-RW
Floppy drive
Graphic interface
Operating system: Windows 7
I/O interface PS2, RS232, USB, network
LCD flat screen monitor 26 inch or 2x 19 inch monitors
Mouse and keyboard

*** configuration may change without notice due to the quick development of the electronic market*

Additional software options:

COIN WIN 3 D ANALYZER
Coin win: 3 D tomography software module for visualisation of holes files.

TCP IP REMOTE CLIENT
External remote control of the microscope, loading of recipes, start of auto scans, tray scans, sequence scans, transfer of analysis results to host, embedding of bar code readers, HERMOS readers e.g.

EXTERNAL REMOTE ACCESS
REMOTE package of technical applications support services via modem, internet or direct phone contact to assist users with setup for new application or general technical support.

SURFACE CONVERTER
Offline software for reconstruction of time of flight surface effects (bending, warpage)

WINSAM OFFLINE
External WINSAM 5.8 software (including dongle), installation on external PC

SAMNALYSIS ANLYSIS SOFTWARE:

1. Time of flight analysis
2. Sliding window Analysis
3. Thickness estimation

4. Sound velocity estimation

5. Delamination analysis

6. BAI analysis method for imaging internal structures and deviations with enhanced contrast

7. Sophisticated spectral analysis methods

8. Numerical deconvolution algorithms for extended delamination evaluation

9. 3-D Volume Analysis and Imaging

10. 3-D rendering of internal structures and surfaces

11. Variety of features conveniently edit SAM-images (contrast adjustment, zooming, image interpolation); create images off-line from recorded data-sets

12. Full access to unprocessed rf-data (export as *.ascii, *.txt or matlab-compatible data files)

13. Quantitative analysis for extraction of defects or internal structures of the investigated sample; various methods for accurately removing sample tilt

14. Result data base for convenient handling of data sets and analysis results;
several analysis can be applied to one and the same spot and results can be compared

15. Full access to scan parameters

16. Semi-quantitative-parametric-imaging analysis

17. Image storing in various formats including vector-graphic-formats

Additional hardware options:

Through scan mode including software and 1 transducer, adapter and cable set

HILBERT signal filter

High dB pre amp

High resolution pre amp

Time corrected gain interface

High resolution ADC board

Vacuum trays for 2, 4, 6, 8, 12 inch wafer, other sample geometry on request, including hardware

Water recirculation systems

Water filter: different particle size (standard: 50 µm), metal ion filters

Offline and integrated sample drying systems

Barcode reader implementation

Working table (100 x 80 x 74 cm)

Transducer:

Transducer <10 MHz: on request
Transducer10 MHz / f=0,80” focal length
Transducer 15 MHz / 0,75” focal length
Transducer 20 MHz / 10 mm focal length
Transducer 25 MHz / 20 mm focal length
Transducer 30 MHz / 12.7 mm focal length
Transducer 30 MHz / 30 mm focal length
Transducer 30 MHz / 40 mm focal length
Transducer 50 MHz / 10 mm focal length
Transducer 75 MHz / 12,7 mm focal length
Transducer 80 MHz / 9 mm focal length
Transducer 100 MHz / 8 mm focal length
Transducer 110 MHz / 8 mm focal length
Transducer 125 MHz / 9 mm focal length
Transducer 150 MHz / 10 mm focal length
Transducer 150 MHz / 5,9 mm focal length
Transducer 175 MHz / 2 mm focal length
Transducer 175 MHz / 3,2 mm focal length
Transducer 175 MHz / 8 mm focal length
Transducer 230 MHz / 2 mm focal length
Transducer 230 MHz / 3,2mm focal length
Transducer 230 MHz / 8 mm focal length
Acoustic objective 100 or 200 MHz, 60 degree opening angle
Application specific tranducer: on request

Environmental and Utility Requirements:

Voltage	200-240V 50Hz Single Phase 100-120V 60Hz Single Phase
Power consumption	1 kVA
Ambient Temperature	15-30°C
Relative Humidity	less than 70%
Cooling Water	not required
Compressed Air	not required (only in case of vacuum chucks)
Weight	700 kg (work bench not included, see option list)

The environmental and utility requirements shall be the responsibility of the customer and shall be provided at the time of installation. Failure to comply with these conditions may adversely affect the performance figures quoted in this specification.

SAM 400 Tool Layout & Footprint