MX 202
Automatic Wafer Sorters

Due to their high reliability and throughput, E+H sorters are the best choice for geometry sorting between the various stages of wafer manufacturing (after cutting, after lapping).

> 500 w/h (8")
> 700 w/h (6")

They are also used to monitor deformation (warp) across the various process steps in chip production. E+H sorters are available in three versions covering the range from 2" to 200 mm wafers.

They consist of self-contained measuring and handling modules. Each module has its own independent wafer transport system including stepper motor, twin parallel polyurethane transport belts, and a sensor system to detect and stop the wafers when centered. A master microprocessor in the sorter controls all these modules and transmits the raw data to a PC.

Based on these data, the PC software computes the following parameters:
- Thickness parameters (center thk., avg. thk., min. thk., max. thk., TTV)
- Global flatness parameters (max. neg. FDP, max. pos. FDP, TIR)
- Warp parameters (bow-bf, max. neg. warp. max. pos. warp. total warp)
- Resistivity (center resistivity, resistivity at r/2, resistivity gradient)
- Conductivity type (P/N)

At the beginning of the transport belt path, there is one or up to four emitter modules (lifts). The actually active one is moved automatically to feed the wafers directly straight into the first measuring station. So the wafers do not have to change the transport direction.

Available measuring modules are:

- T   thickness module, center thickness only
- G   geometry and thickness module
- R   resistivity module (needs T or G for resistivity calculation)
- P/N type (optionally integrated in R)

To collect the sorted wafers, there are two opposite pairs of wafer receiver modules (lifts), 24 are possible in total.
Between every pair of opposite receiver modules, there is a transport module called the wafer switch, which either sends the wafers to the left- or right hand side receiver, or advances them to the next switch.

The wafer send- and receive lifts are identical; their operation mode is set by means of a switch. All lifts are connected to a common parallel bus. They receive commands from the master microprocessor via this bus, and issue status messages. They require a common +24V DC power supply.

The base of the sorter consists of a rugged table composed of aluminium elements, covered by a 15 mm thick aluminium plate. All modules are mounted to this plate, they are easily detachable. 19 " electronic racks, power supplies and cables are located beneath that table top. The sorter can easily be disassembled for transport. Its feet are height-adjustable.

Supplied Software
- Service programs allowing to test mechanical functions and position sensors of every module independently.
- Calibration-, recalibration- and quick check programs for every measuring module.
- A program sorting wafers automatically according to special setup files which are called recipes. These may be changed by the user according to his needs. They contain information such as

    - which wafer geometry and resistivity characteristics are to be computed
    - how the sorting limits are set for every sorting class
    - which receiver modules are assigned to each class

The program has a number of display windows showing
- all parameters of the currently measured lot
- all measured and computed wafer characteristics
- all thickness- and local warp values at the corresponding sensor positions
- statistical information
- messages, warnings, errors

For more information, see 'MX-NT New Evaluation Software for E+H Wafer Geometry and Resistivity Tools' below.
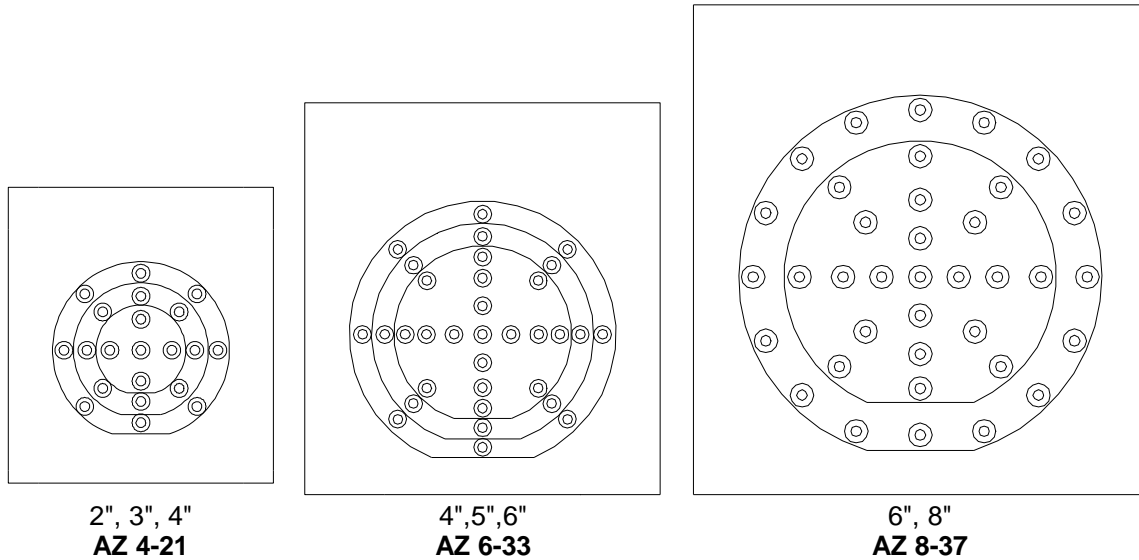
Geometry Module

The main measuring module is the wafer geometry module, which consists of an upper and a lower probe head. The transport belts feed the wafer into the 2.5 mm wide air gap between the probe heads, a light barrier centering system detects and stops the wafer inside the module, then the belts are lowered, and finally the wafer lays down on three polished resting points during measurement.

This well defined 3-point resting during measurement allows a mathematical gravity correction according to SEMI M1.

In every probe head of the geometry module, there are up to 37 capacitive distance sensors. They are embedded in a 20 mm thick steel plate. The sensor pattern is a star-shaped center-symmetric radial pattern.

The system automatically scans the wafer by performing one distance measurement from a sensor in the bottom probe head followed by another one from the opposite sensor in the top probe head. The number of sensor pairs used to sequentially scan the entire wafer depends on the wafer diameter: 5 with 2 " wafers and 37 with 200 mm wafers.

Standard versions (*) for different wafer diameters:

2", 3", 4"	4",5",6"	6", 8"
AZ 4-21	**AZ 6-33**	**AZ 8-37**

Technical Data

Gauge Type	**4-21**	**6-33**	**8-37**	
Thickness range	200 - 700	300 - 900	400 - 1000	µm
Total distance between probe plates	1,900	2,000	2,500	µm
Measuring points per wafer				
2"	5			
3"	13			
100 mm	21	17		
125 mm		25		
150 mm		33	21	
200 mm			37	

Sensor Characteristics

Distance measuring range	1,500	1,500	1,725	µm
Resolution	14	14	14	bit
Repeatability	± 0.1	± 0.1	± 0.15	µm (2σ)

(distance measurement, wafer at rest, constant temperature)

Gauge Accuracy (at calibration temperature)

Absolute thickness accuracy	± 0.5	µm
Flatness accuracy	± 0.3	µm
Precision (measuring a wafer ten times)	± 0.15	µm (1σ)
Bow/Warp accuracy	± 3 µm + 5% of reading	

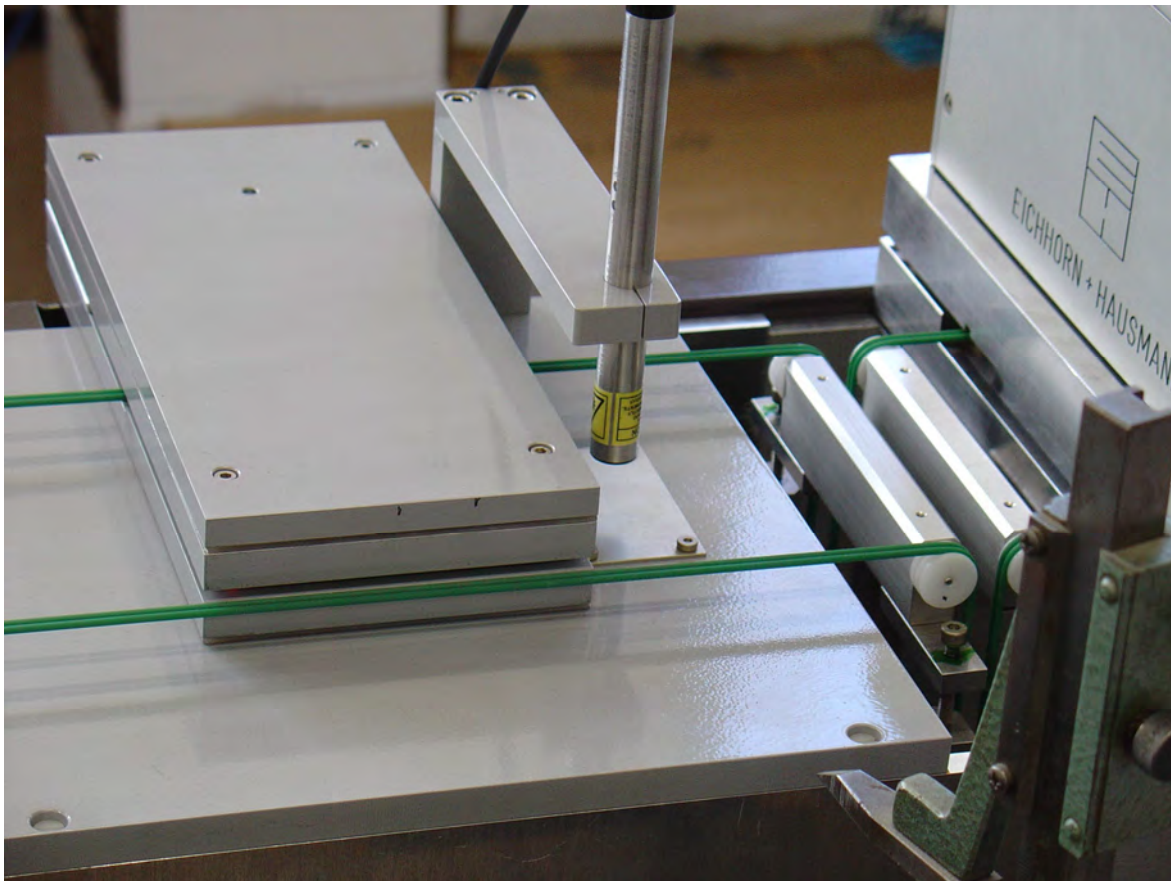*) Special versions available for:
• very thin wafers (after backside grinding)
• semi-insulating Gallium-Arsenide wafers (no warp/bow)

Resistivity Module

The wafer resistivity measuring module uses the well known eddy-current method. There are two sensors, one for a low resistivity range (1 to 500 mOhm cm) and another one for a high range (0.2 to 200 Ohm cm). Both are arranged next to each other over the transport line embedded in an aluminium plate. A light barrier detects the arrival of the wafer in the module. Depending on wafer diameter and resistivity range, the wafer is then advanced by a certain number of motor steps. The first measurement is performed at the center of the wafer. Then, the wafer is advanced by half of its radius; a second resistivity measurement is performed allowing to additionally compute the resistivity gradient.

- Center Resistivity
- Resistivity at R/2
- Resistivity Gradient

Accuracy °)	0.001 – 80 Ohm-cm	+/- 1 % ")
	200 Ohm-cm	+/- 5 %
Precision *)	0.001 – 80 Ohm-cm	+/- 0.2 %
	200 Ohm-cm	+/- 2 %

Conductivity Type

A contactless P/N sensor can be integrated in the resistivity module. It uses a photovoltaic principle and works in the entire resistivity range above 20 mOhm cm.
Alternatively, it can be mounted to measure from top or from bottom.
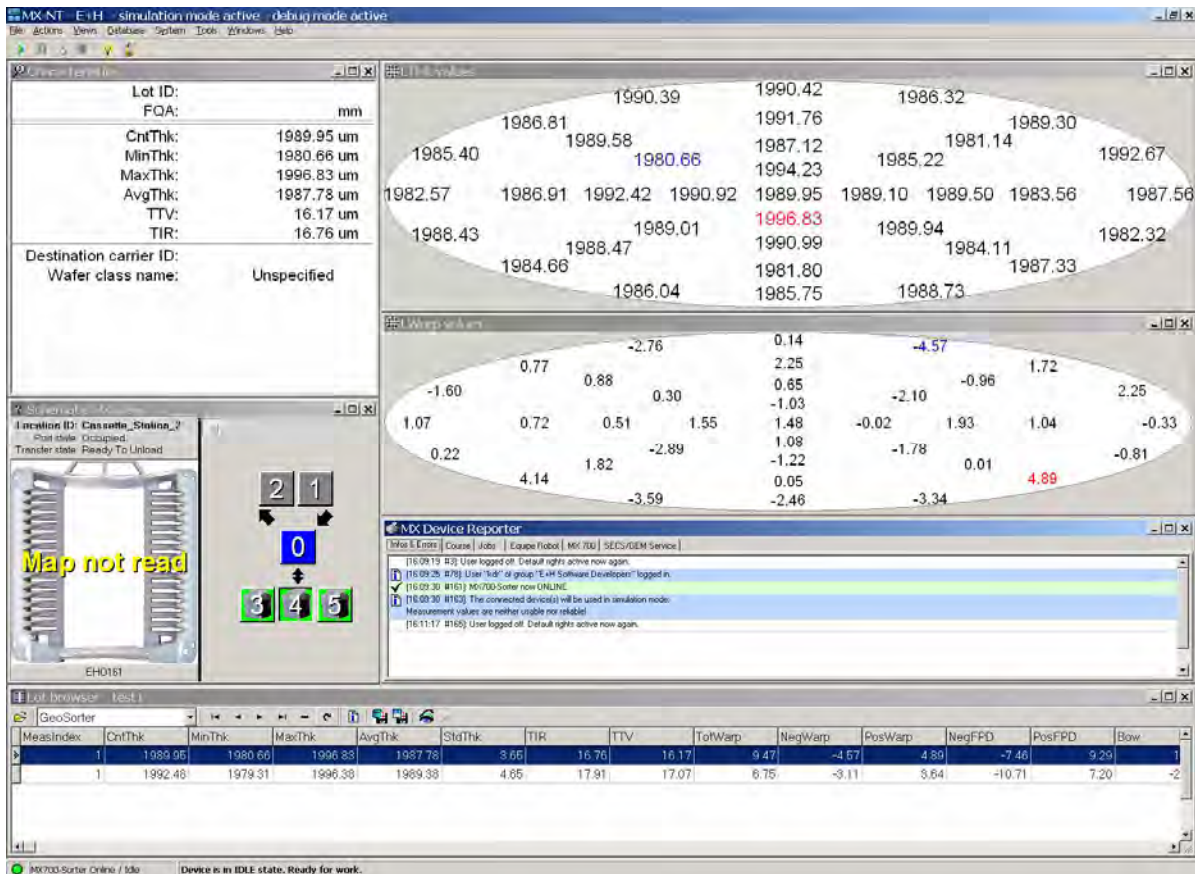

°) Deviation of real value, average of repeated measurements are within these limits
*) Repeatability including handling, 1 sigma STD of repeated measurements is within these values

") Depends on quality of calibration samples

New Evaluation Software for E+H Wafer Geometry and Resistivity Tools

Introduction

MX-NT is the new E+H integrated, modular and universal measurement software for all E+H MX devices, the modern successor of MultV4, SCAN8, SortProg and other popular E+H and proven data analysis software.

MX-NT intragrates all E+H measurement heads, material handlers and even devices of other manufacturers into one product. The modular architecture of the software grants a high level reusability of software components and contributes to a high stability of the whole software.
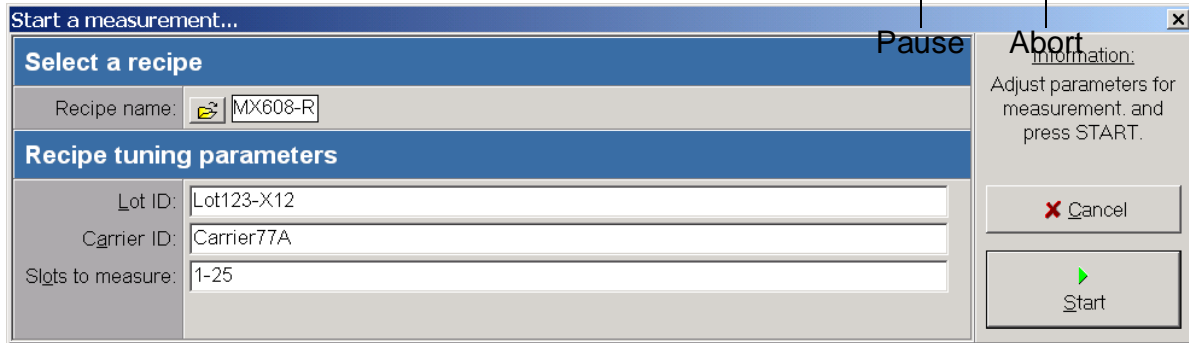
Therefore MX-NT can be used for all E+H tools which means for you as an engineer and your operators:

Once familiar with MX-NT you can work instantly on any E+H tool!

Easy to use

The software works for all tools on equal terms. Initiate measurements even on complex tools by a simple and self explaining button click onto symbols you already know from your tape deck at home.

Start   Resume

Adaption

Pause   Abort

Start a measurement...

Select a recipe

Recipe name: | MX608-R

Recipe tuning parameters

Lot ID: | Lot123-X12
Carrier ID: | Carrier77A
Slots to measure: | 1-25

Information:
Adjust parameters for measurement. and press START.

✗ Cancel

▶ Start

Create your own recipes and data base structures and adapt them to the guidelines of your company. Let the operator enter only the most neccessary data (like lot name or slots to process) or even nothing. Create your own desktop views by placing windows with text based or graphical measurement data views, report messages, status messages and data base lot views. Grant or refuse access to the MX-NT program functions with our free UniPas user administration software.

Connectivity

MX-NT comes along with MS Access database support, but can also be used with server based relational data base management systems (RDBMS). Access the database from your workplace though the network with our optional
MX-Explorer[1] tool.
For higher automation levels a **unified SECS/GEM** interface is available which has to be ordered separately[2].

ORACLE

Microsoft SQL Server 2000 Standard Edition

SECS/GEM Interface
according to SEMI Standards
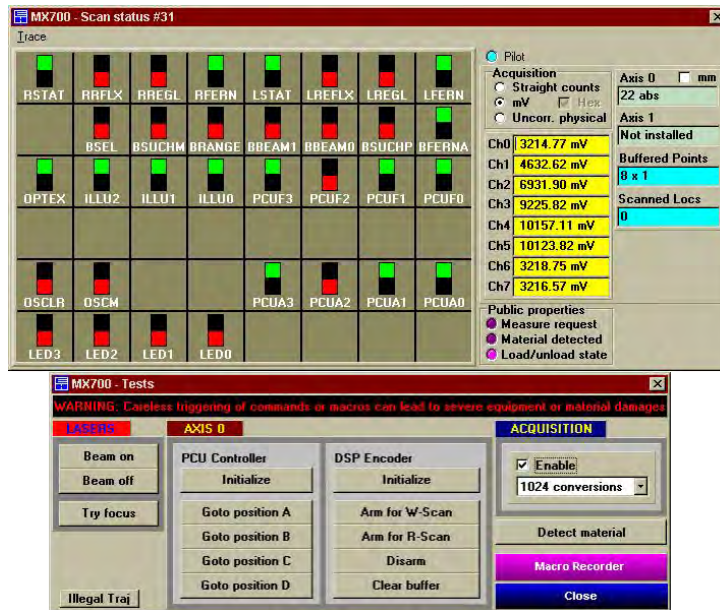
Microsoft Access

Included Standard Software

EHMaster - Standalone Maintanance
The standalone version of the maintenance main tool. Used for equipment parametrization, mechanical tests, sensor and position displays, firmware updating and triggering and inspection of raw measurement data.

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[1] Licences have to be ordered sparately
[2] Includes also drivers from GW Asc.

Unipas - Universal Password Protection System
Create users and assign their membership to user groups. Grant or refuse user groups access to program items.

Specification Data

Supported E+H devices	MX102, MX202[3], MX203, MX204, MX2012, MX608, MX700, E+H Wafer mapper, E+H Light Tower, E+H carrier stations
Other devices	PRI Robot, PRI Aligner, Fixload, Fixmap, Hokuyo E84 AMHS interface[4], Hermos ID reader
Supported characteristics[5]	Thickness, Global Flatness, Warp, Bow, Resistivity, Dotation
Views	Characteristics, Local Geometry, Scan, Lot Browser, Device Reporter, Schematic Device Display
Export filters	Comma Separated Values (CSV) Boin Wafermap 3.0 (MAP)
Database support (through ADO)	MS Access, MS SQL Server 2000, Oracle 9i (not included)
Operating systems	Windows NT 4 (SP6, IE6, MDAC 2.7), Windows 2000 (SP2), Windows XP Prof.
PC Hardware	Not included. Please order separately or request min. requirements

Optional Add Ons (please order separately)

Additional characteristics	Subject to Tapes
SECS/GEM support	SECS/GEM interface through HSMS according to our Remote Host Interface Specification RHIS 2.1x

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[3] Only available if MX202 is ordered together with MX-NT
[4] Through Fixload
[5] Depending on the installed measurement head(s)