

- ✓ Over 35 years experience in manufacturing production grade X-Ray systems
- ✓ World-wide reputation. Several hundreds of equipment in operation around the world
- ✓ Standard or customized equipment for all applications

The GM Series X-ray measurement systems are general purpose heavy duty production units especially designed for measuring the orientation of crystal products with respect to a selected crystallographic plane. In particular cases, orientation processes of small to medium size crystals can be performed with the help of dedicated holders and jigs. All single crystals can be processed, for all applications such as semiconductors, opto-electronics, optics, etc.

#### APPLICATIONS

##### ◆ Orientation measurements

- Crystal face (Wafer, blank, block, bar, etc..). Depending of sample size, dedicated holder(s) may be required.
- Ingot flat
- Wafer flat and wafer notch (optional holder)
- Seed axis of round or square seeds (optional holder)

##### ◆ Orientation processes

- Flat orientation on medium size OD ground ingots
- Crystal face, with specific adjustable holders.

#### VERSIONS AND CONFIGURATIONS

##### ◆ Capacities

- for loads up to 10 kg
- for loads up to 25 kg
- special versions for loads up to 100 kg
- Custom made versions
- Dual-station, including mixed versions with a station of GM.SI or GM.WS series.
- Dedicated holders for all applications

##### ◆ Double diffraction option

The GM series goniometers are available either for single diffraction operation, which is sufficient for most applications relating to semiconductors, or in double diffraction configuration with an incident beam monochromator.

The standard monochromator is a Quartz crystal with plane (01-1).

Different configurations with other crystals such as LiF, Si, Ge, etc.. can also be supplied.



Standard single station GM series X-ray unit with 8" wafer holder

#### DIGITAL ANGLE DISPLAY

##### ◆ Display options

- Decimal : resolution 0.01° - 0.001°
- Degrees, minutes, seconds : 1 or 5 seconds
- PC and software : decimal and deg. min. sec. Any resolution. Simultaneous display of absolute and relative angle values. Standard or customized software. Storage of measured data.

All display versions enable reset to zero at any position. Absolute or relative angle values can be alternatively displayed. Automatic recalibration at start-up or at any time.

#### DOUBLE DIFFRACTION VERSIONS

In a single diffraction goniometer, the sharpness of the reflection peak depends mainly on the beam divergence, which comes out of the collimator. Even in the very best conditions, it is not possible to get a reflection peak enabling a measuring accuracy better than  $\pm 10$  to 15 seconds.

With the double diffraction configuration a first crystal "monochromator" is mounted directly on the path of the incident X-ray beam. This allows the beam to be made parallel by Bragg reflection on a family of reticular planes. Its divergence in this case is only of a few seconds of arc. After reflection on most samples, it becomes monochromatic resulting in an extremely sharp reflection peak. Our unique electronics with "peak amplifier" enables its detection with an accuracy of 1 to 2" of arc.

#### RANGE OF OPERATION

- Goniometer rotation range : -10 to 110°, with fast/coarse and slow/fine rotation control over the whole rotation range.
- Detector setting range : -10 to 110°. Detector can be indexed at several dedicated positions (option).

#### PERFORMANCE (Single diffraction)

- Measurement accuracy :  $\pm 0.005^\circ$  to  $\pm 0.02^\circ$ , depending (in particular) of crystal type, plane and surface condition.

#### PERFORMANCE (Double diffraction)

- Measurement accuracy :  $\pm 2$  seconds to  $\pm 15$  seconds depending of crystal type, plane and surface condition.

Examples : Quartz (01-1)  $\pm 1$  sec repeated over 20 measurements. Quartz (02-3)  $\pm 2$  sec/30 measurements.

**Measuring tests can be made on customer's samples.**

#### X-RAY GENERATOR

- Output voltage : 30 kV – DC
- Maximum rating : 30 mA
- X-ray tube : copper target, water cooled. Other targets on request.
- Apparent focus : linear fine focus. Spot focus when required.
- Mains : 220 V 50/60 Hz, 1-phase, 5 A
- Water supply : 2.5 bar. Flow rate 3.5 l/min

#### DETECTION UNIT

Proportional counter linked to a special integrator with peak amplifier, giving a high detection accuracy.

Optional long window detectors for detection of a beam reflected by strongly tilted planes (crystal plane is inclined, not parallel to goniometer axis).

Voltage is adjustable from 1000 to 1850 V

Voltmeter and adjustment potentiometer are located in the casing facing the operator



Stainless steel vacuum holder for wafer face orientation measurement. Engraving for accurate positioning of the wafer flat or notch. Models for wafers up to  $\varnothing$  300 mm.

## SPECIMEN HOLDERS

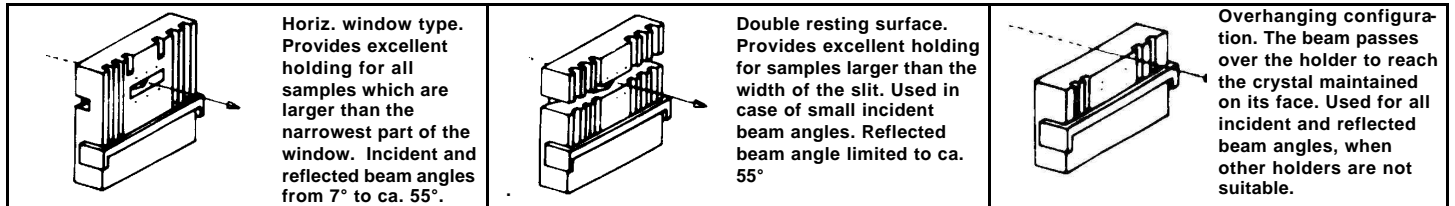
One of the greatest advantages of the GM series X-ray units is the capability which is offered to install an infinite number of attachments such as specimen holders, tables, slides, jigs and other fixtures in order to use the equipment for different applications.

Besides, the mechanical concept of the unit enables such changes without the need of any beam re-alignment, mechanical setting or calibration. Depending of the attachment, time involved for this operation ranges from a few seconds to a few minutes.

The sample can be maintained on all types of holders either by an adjustable spring pusher or by vacuum.

Although small crystal sections can still be measured with good accuracy (for ex. wafer flats of  $0.3 \times 8$  mm) the best measurement reliability is ensured when the crystal face is sufficiently large for being properly and accurately hold on the specimen holder. Further process steps such as dicing can be made after orientation check, since such process does not affect the crystal face orientation.

A large number of specimen holders is already available for all kind of applications. When needed, customized models can be offered.



Holder for wafer flat orientation measurement. To use with with vertical window holder.



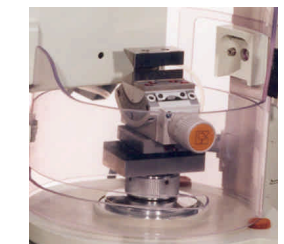
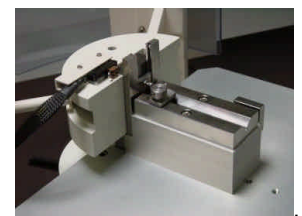
Standard holder with vertical window. Commonly used in many applications.



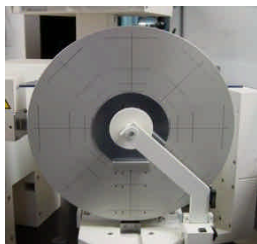
Holder for small incident angle beams. Must be used for ex. with  $\text{LiNbO}_3$ ,  $\text{LiTaO}_3$



Holder for seed orientation measurement. Instantly mounts on the goniometer table.



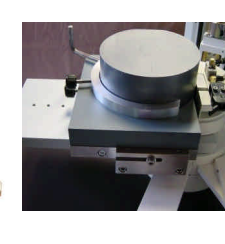
Special tilting holder for measurement of crystals with inclined planes. In some cases, long window detectors can be used as an alternative.



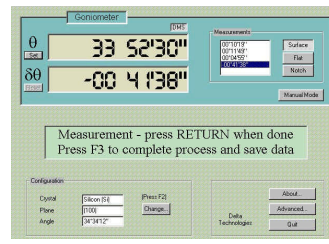
Motor driven rotating holder for wafer orientation measurement. PC calculates total plane offset and offset direction



Holder for wafer flat and notch orientation measurement. Wafer diameter from 100 to 300 mm.



Holder for orientation process of ingot flat. The ingot holder is used to transfer the ingot orientation to the grinder



PC display option (See page 1) Displays decimal and sexagesimal degrees. Standard or customized software. Storage of up to 4 measurements per sample.

## SAFETIES AND PROTECTIONS

The equipment has been designed to offer both maximum protection and easy operation.

- **Electromagnetic rotary shutter** controlled by a non latching foot switch.
- **Shutter interlock switch** actuated by the sample in measuring position
- **Green / Red control lights** : indication of shutter status.
- **"X-ray ON" light** with automatic equipment shut-off in case of lamp failure.
- **Shields and screens** stop direct or scattered radiation

## CUSTOMIZED EQUIPMENT

Despite of the large variety of equipment and accessories offered, the equipment must often be customized in order to fulfill the user's requirements, particularly with respect to the size and shape of samples. **This catalog does not show all available holders.**

If the samples to be measured cannot be properly hold by the standard holders mentioned in this catalog, or already supplied for similar applications, we can still offer specific solutions.

This can be the case for instance when the samples to measure are smaller than the X-ray beam aperture of the sample holder fitted to the goniometer.

For any such application, consult us.



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