
Thin Film Deposition Monitor and Controller



The Film Deposition Monitor and Controller has been designed to measure the electrical resistivity and optical density of thin evaporated films and to control directly the deposition rates of evaporation equipment to obtain of films uniform thickness.

The modular system design of the controller allows the equipment to be upgraded at any time to accept up to 32 optical

and 32 resistivity probes, simultaneously.

The Resistivity Monitor is based on an IBM compatible PC. Various interface cards may then be mounted in the rack as required by the system. The system is modular - comprising a hard disk, a floppy disk and an integral keyboard. An external keyboard may be also connected.

Features

- Non-contact measurement of electrical resistivity from 0.5 ohms/square to 10 ohms/square (100 ohms/square with special probes)
- Non-contact measurement of optical density up to 4.5 OD (5.6 OD with special probes) of films on plastic webs or glass
- Measures either opposite an insulated roller (single beam system) or between rollers (2 beams system)
- Both resistivity and optical density measurements can be made simultaneously
- IBM PC compatible with various interfaces: RS232, printer etc.
- Probe Readings Histogram displayed directly on the Colour Bar Chart
- Intelligent on-line HELP facility, including clear operating instructions for ease of operation and freedom from operator errors
- Simple and fast calibration procedure
- Controller may be used either with clutch or stepper motor wire feed system
- Fully automatic process control achieves film uniformity of 0.1 OD or 2% to 5% of the pre-set value with resistivity probes

Principle of operation of Resistivity Probes

The film resistivity is determined by placing the film in a high frequency electro-magnetic field (radio-frequency RF field). A conductive film absorbs small amounts of the RF power. The amount of absorbed power is measured by the RF probe and converted by the system into the resistivity reading.

Up to 32 probes can be mounted on a single aluminium beam. The beam is mounted 1mm to 2mm from the roller. The metal roller should be coated with at least 30mm of non-conducting material. The measured web passes between the beam and the roller.

For equipment without an insulated roller, a two probe system, with two identical beams should be installed. The RF power is induced from probes on one beam and measured by probes on the facing beam. The separation of beams is typically 53mm. The measured web passes between the two beams which are mounted away from the rollers.

Principle of Operation of Optical Probes

The light from Light Emitting Diodes (LEDs) mounted on the back of the rack (or on the transmitter beam inside the chamber), is collected either by optical fibres or directly by detectors mounted on the other half of the optical beam (the receiver beam). The film passing between the light source and the detector absorbs a proportion of the light. The amount of light transmitted through the film is measured, converted into optical density or optical transmission and displayed. To ensure that the transmitter beam and receiver beam probes are aligned, the beams are rigidly fixed together and separated by 40mm. The measured web passes between the two beams.

Combined Optical Density and Resistivity Measurements

Both the optical and RF probes may be combined to offer a multi-function instrument. The optical density and electrical resistivity measurements may be performed independently and simultaneously.

The film deposition rate is, normally, controlled by varying the electric current to an electron gun or by altering the evaporant feed rate by controlling mechanical clutches and electrical motors.

Closed Loop Controller

Signals from each (RF or optical) probe are processed using a suitable algorithm to calculate the necessary feedback. This feedback signal is processed by the Closed Loop Controller interface card to provide a suitable output for clutch solenoids, electrical motors or electron guns. Each boat or electron gun is individually controlled to deposit film of required profile and thickness. The system compensates for the overlap between deposition distribution between adjacent boats.

System Specification

MONITOR

Resistivity Range	0.5 to 10 ohms/square
Reproducibility	± 3%
Optical Transmission	0.1% to 100%
Optical Density	up to 4.5 OD
Reproducibility	± 1%
Number of probes	any up to 32

SVGA Display

A colour Bar Chart display showing one bar per probe. Bars change colour when the reading exceeds pre-set limits.

Interfaces

Digital (RS232) or analogue to communicate with a PLC or a printer.

Dimensions

Separation between - adjacent probes

60mm (resistivity) 30mm (optical)

- beams

53 mm (resistivity) optical 30 mm approximately

- resistivity probes and film

1 to 2 mm (single beam system)

- in dual beam system

4 ± 2 mm

CONTROLLER

Wire feed rate update Lock on time

every 0.5 sec
5 to 45 sec determined by step size

Tracking accuracy with resistivity probes with optical probes

2% to 5% of the set value
0.1 OD

Electronics Rack

19 in rack 460 mm deep 6 U high.

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