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Sachbearbeiter/in LÄ/gb

Durchwahl 0 64 20/⁹¹~~803~~ - 22

Datum

15.08.1991

Ihr Zeichen

Ihre Nachricht vom

Betr.: Schwingquarz für FTM3

Sehr geehrter Herr Kallauch,

wie mit Ihnen am 14.08.1991 telefonisch besprochen senden wir Ihnen ein Muster des Schwingquarzes und ein Angebot über ein Quarzhalter zu.

1 Stück Quarzhalter
Best.-Nr. E086-67-000

DM 1.530,--

Wir hoffen Ihnen hiermit gedient zu haben und verbleiben

mit freundlichen Grüßen
EDWARDS, KNIESE & CO
HOCHVAKUUM GMBH

i.A. Bilderbeek

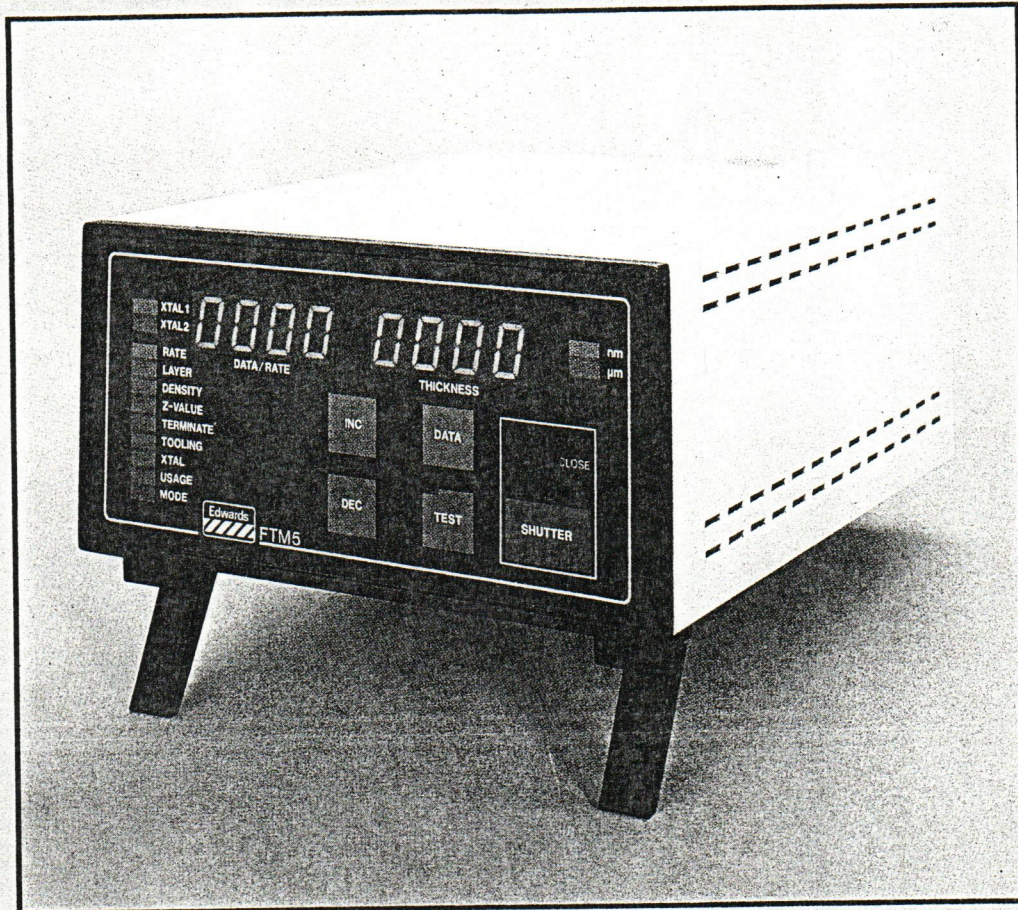
i.A. G. Bilderbeek

Anlagen: Muster Quarzkristall
Info Schichtdickenmeßgerät

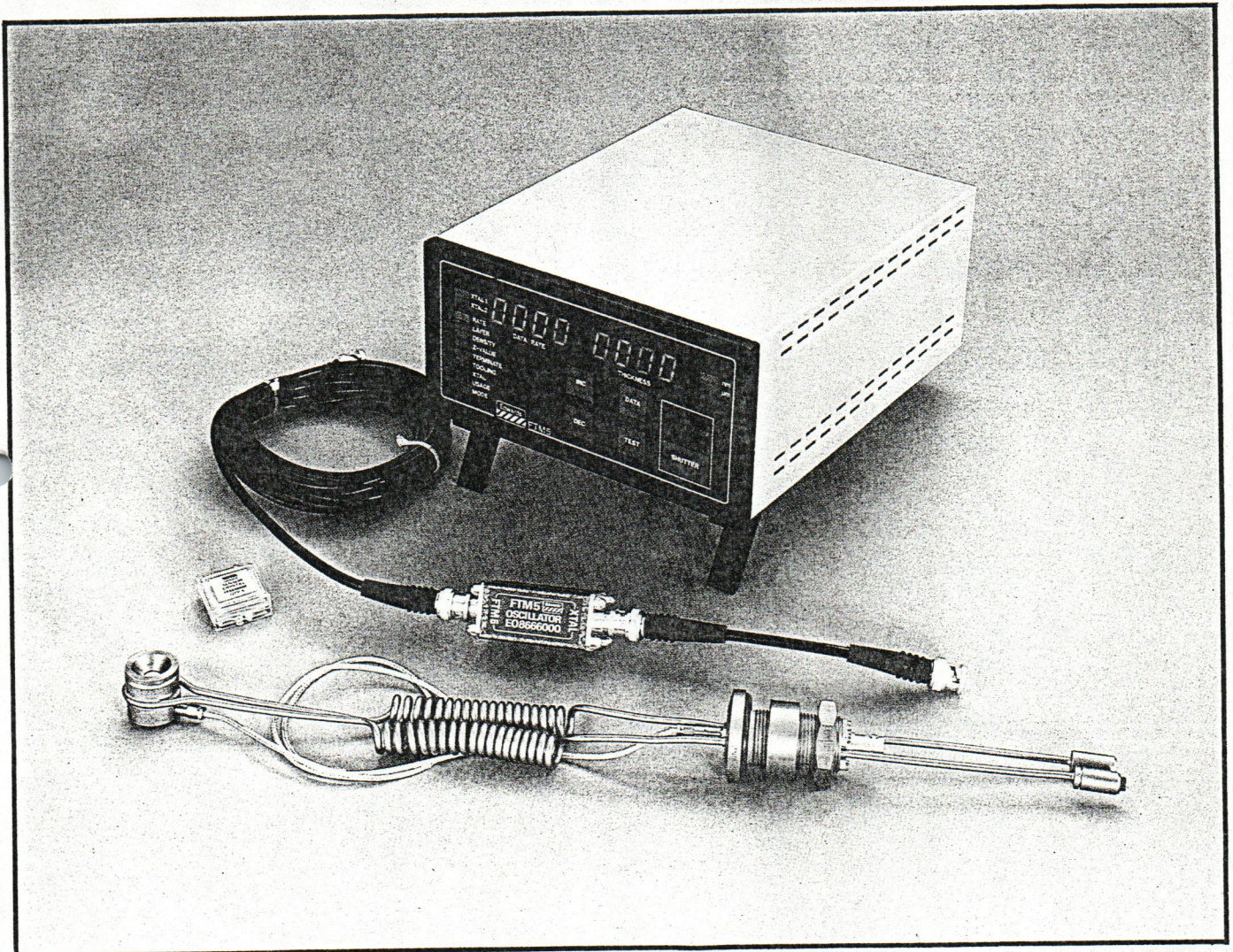
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Model FTM5



Digital film thickness monitor

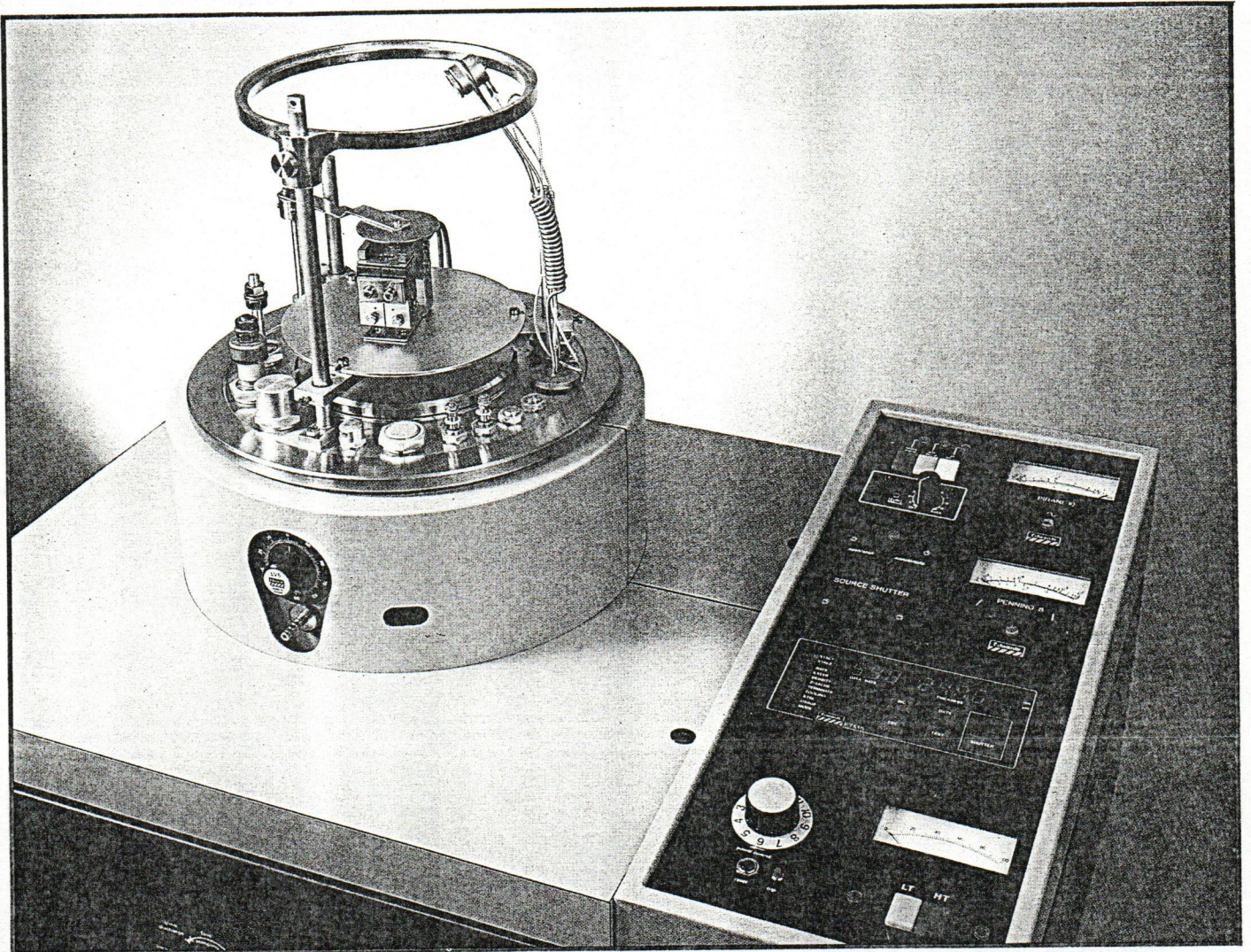


Model FTM5

Digital film thickness monitor

Features

- Dual crystal capability
- Information storage for five materials
- Suitable for most processes including sputtering and etching
- Digital display of deposition rate and film thickness
- Single structure crystal holder with easy "snap-in" crystal changing
- Fits all types of deposition systems
- Compact DIN case suitable for bench or panel mounting



The FTM5 is a complete film thickness monitoring system providing accurate and reliable measurement of metal and dielectric films during deposition in a vacuum coater.

The system comprises a control unit with clear digital displays, a water cooled crystal holder with a starter pack of five crystals, an oscillator and all interconnecting cables.

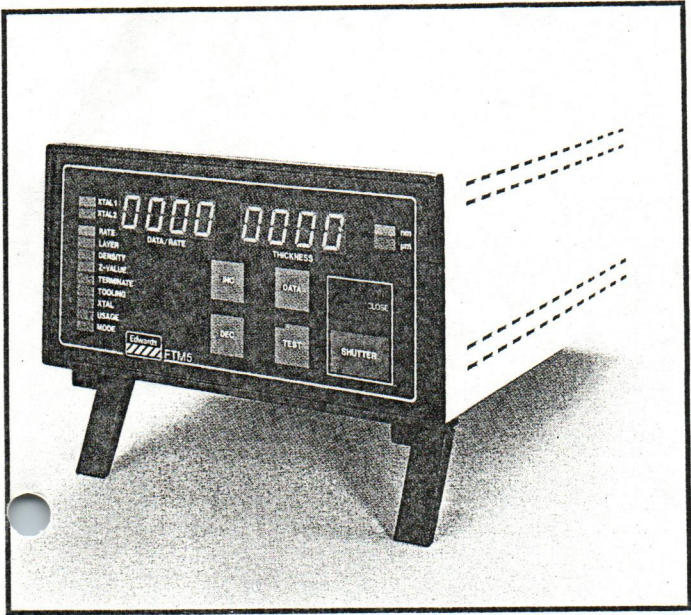
The FTM5 monitors film thickness and deposition rate using the well-established quartz crystal microbalance technique. Thickness and deposition rate are derived by combining the signal from the crystal with user-entered data on density and acoustic impedance of the film material. Data for up to five layers can be stored in the battery backed memory.

One or two sensors may be connected to the instrument. Alternative modes allow the second crystal to be used as a back-up to the first, or as an alternative primary sensor selectable according to the film being deposited.

'Tooling Factors' determined by the user compensate for different detector/substrate geometries so that the monitor may be used on a variety of deposition systems.

Automatic termination of deposition is provided by remote shutter operation at thicknesses selected by the user.

A particular feature of the FTM5 is that it is capable of displaying both positive and negative frequency shifts. This enables the operator to monitor material being removed from a pre-loaded crystal so that the FTM5 can be used for monitoring both the deposition and etching of thin films.



Monitor control unit

The FTM5 control unit combines very simple touch button controls with, clear digital LED displays showing DATA/RATE and THICKNESS.



The RATE display indicates the rate of deposition from 0.0 nm s⁻¹ to 999.9 nm s⁻¹ with a 0.1 nm s⁻¹ resolution.



The THICKNESS display covers the range 0.0 nm to 999.9 μm with LED indication of the scale factor. The thickness resolution is 0.1 nm.

Thickness sampling rates are varied automatically between one and four times per second depending on the deposition rate.



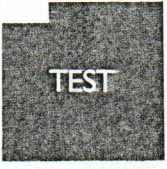
The DATA keypad enables information for the current layer to be displayed on the DATA display either for information or modification by means of the INC (*increment*) and DEC (*decrement*) keypads. The film parameter displayed is indicated by an appropriate LED on the bar graph.

The data which can be called-up are:

- LAYER identifies the current layer whose data are being used to calculate the displayed thickness.
- DENSITY from 0.1 to 99.9gcm⁻³
- Z - VALUE (*acoustic impedance*) from 1.0 to 99.9 × 10⁵gcm⁻² s⁻¹
- TERMINATE thickness from 0.1 nm to 99.99 μm with LED indication of scale factor (*nm or μm*).
- TOOLING factor (*the ratio of thickness deposited on the substrate to crystal deposit thickness*). User-entered over the range 0.01 to 99.9 for each crystal.
- XTAL indicates which crystal is being used to monitor the current film in the layer selected mode.
- USAGE represents the loading on the current crystal by displaying the shift in frequency from the unloaded frequency value of 6MHz.



MODE – if two crystal sensor heads are fitted enables choice of back-up or selection of layer to determine which head is used. Also selects analogue output functions from a comprehensive range.

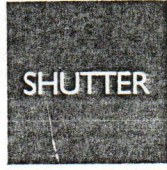


Other controls include:

TEST activates a test sequence which checks that all the front panel LED's are operational and enables the operator to check for faulty segments or indicator lamps. In addition the shutter relay contacts will open and close three times in succession to allow the user to check the operation of any automatic shutters.

The current crystal frequency is then indicated across the rate and thickness displays and at the same time a ramp output is generated on the analogue output channel allowing the recalibration or setting up of recording instruments.

The test mode can be used even if no crystals are connected but the frequency indicated will be zero. Test mode is indicated by illumination of an LED in the top left corner of the 'TEST' button.



SHUTTER controls one pair of normally open relay contacts which are provided to operate the main source shutter. Depression of the SHUTTER front panel button instantly zeros the thickness display and opens the shutter to initiate deposition.

The FTM5 fully protects the depositing film against crystal failure. In the event of crystal failure the shutter is automatically closed terminating deposition. After the crystal has been renewed deposition may be resumed from the cut-off point without loss of thickness information.

This valuable feature can be further enhanced by incorporating a second crystal holder in the system to allow deposition to continue uninterrupted in the event of primary crystal failure. The FTM5 will automatically establish the presence of a back-up crystal and transfer the deposition control to it. A second shutter, normally obscuring this crystal head, can be opened by a second set of shutter relay contacts available at the rear panel. A front panel LED indicates the crystal in current use.



Rear panel facilities

The rear panel carries an IEC fused plug/voltage selector and power switch.

SHUTTER 1 and SHUTTER 2 each have one pair of normally open relay contacts which operate to close the substrate and back-up crystal shutters respectively. The contacts are rated at 500mA, 250V ac, 200V dc, 10W maximum power.

The REMOTE SHUTTER CONTROL provides connexions to the coil of an internal relay rated at 5V dc. Relay operation is equivalent to operating the front panel 'SHUTTER' switch. SHUTTER 1 and SHUTTER 2 are protected by 50mA fuses respectively.

SENSOR 1 and SENSOR 2 are standard BNC sockets for connexion of the main crystal sensor and optional second crystal sensor respectively.

The ANALOGUE OUTPUT is a BNC connexion for a 0-1V output with $1k\Omega$ impedance, to a chart recorder or other indicator. It is programmed from the front panel to output data on rate or thickness with a variety of full scale calibrations both positive and negative.

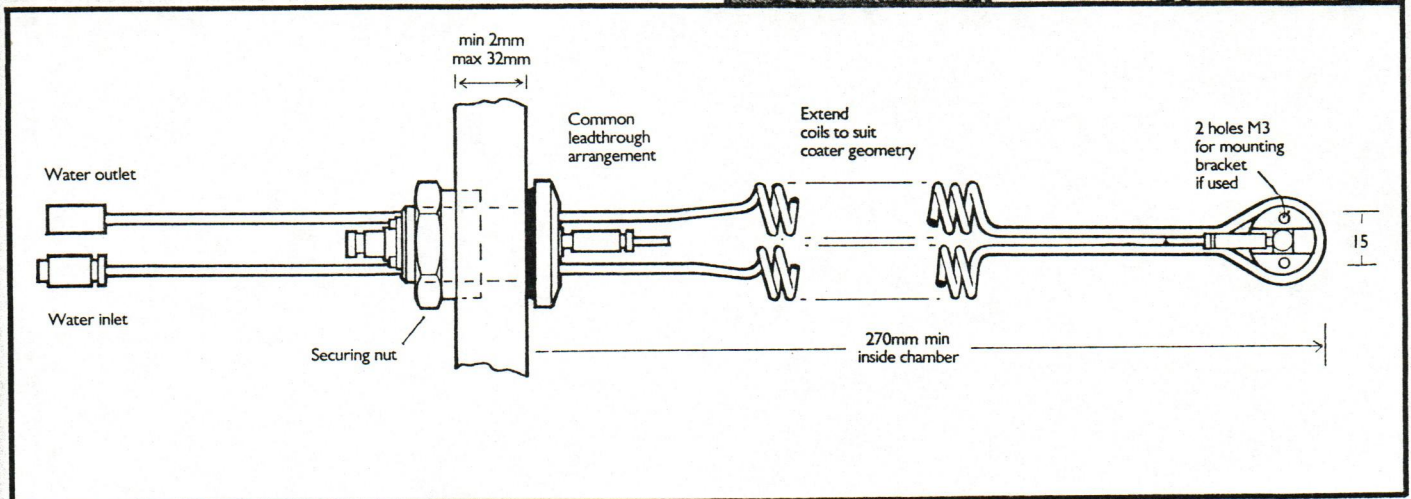
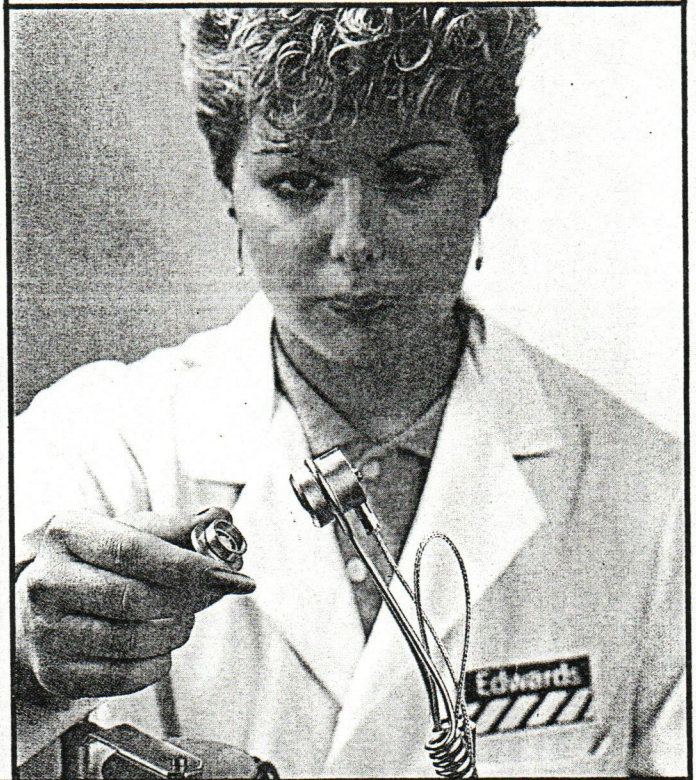
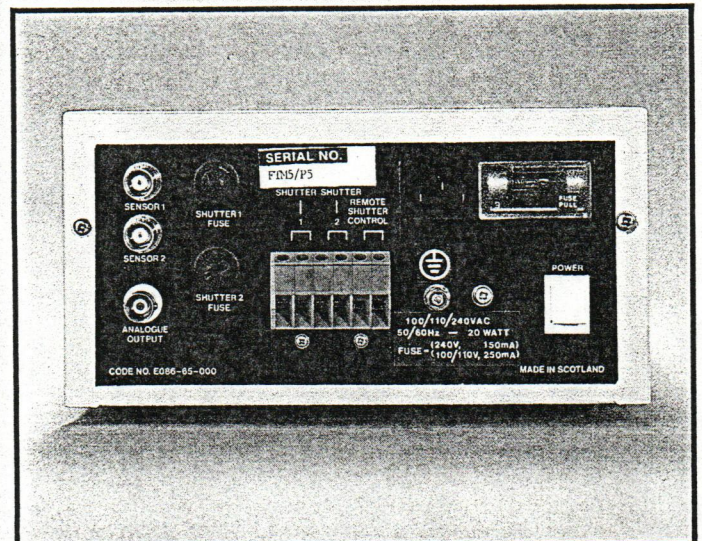
Technical data

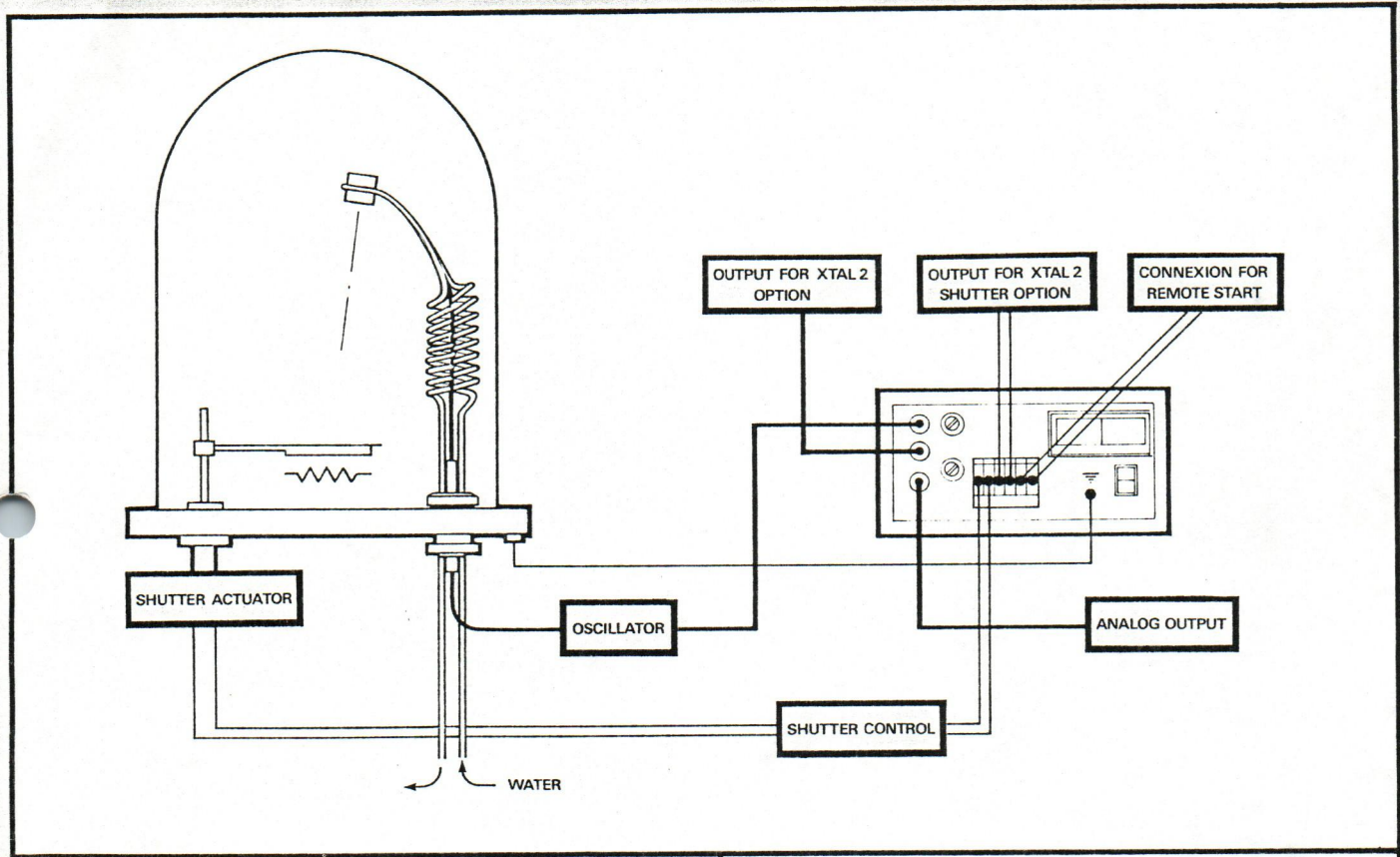
Thickness display	0.0nm to 999.9 μ m
Thickness display resolution	0.1nm at minimum update rate
Rate display	0.0 to 999.9nm s ⁻¹
Update rate	1 to 4 s ⁻¹
Film density	0.1 to 99.9g cm ⁻³
Film acoustic impedance (Z-value)	1 to 99.9 $\times 10^5$ g cm ⁻² s ⁻¹
Tooling factor	0.01 to 99.9%
Thickness termination set point	0.1nm to 99.99 μ m
Sensor crystal display	MHz (± 1 kHz)
Sensor crystal frequency	6MHz
Analogue output	0 to 1V, $1k\Omega$ impedance (8 bit resolution)
Temperature range	0 to 50°C
Shutter relay	240V ac or 200V dc, 500mA resistive. Max power 10W. Normally Open
Mains supply	220-240V/100-120V, 50/60Hz 50W
Mains fuse 220-240V	150mA anti surge
100-120V	250mA anti surge
Dimensions	192w \times 96h \times 243d
Weight	2.9kg

Universal crystal holder

The Edwards crystal holder is a new design suitable for use in most types of thin film coating systems. It is suitable for most deposition processes and works effectively in an RF sputtering environment. Good thermal stability is obtained by water cooling the crystal holder which can also be baked up to 200°C. The flexible, coiled water lines can be extended to allow easy positioning of the crystal head inside the vacuum chamber. The 'snap-in' crystal enclosure makes crystal changing easy and quick.

The standard nominal 25mm leadthrough is an integral part of the crystal holder and is ready for immediate fitting to the coater chamber without soldering or brazing or separate water connexions.



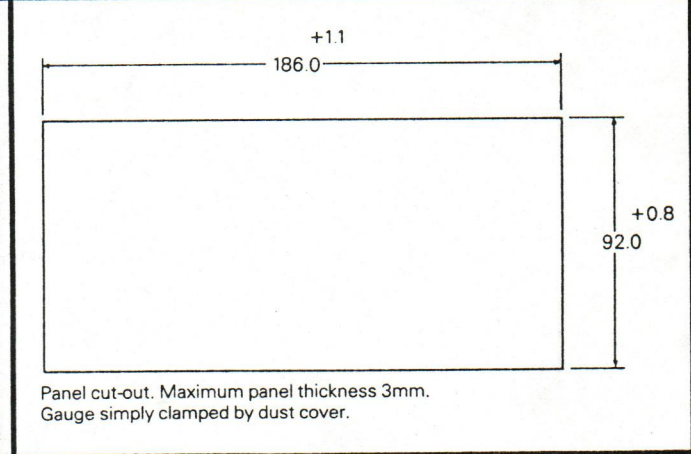


Crystals

The 6MHz crystals supplied for use with the FTM5 film thickness monitor have a plano-convex geometry for smooth frequency response over the life of the crystal and are AT-cut for frequency stability with temperature change. Crystals supplied are 100% tested to assure maximum reliability and optimum accuracy during operation. These 14mm diameter crystals are also compatible with the previous type Edwards Mark 3 crystal holder and other similar holders.

Technical data

Crystal	6MHz 14mm diameter quartz with gold electrodes
Crystal enclosure	Plated copper fitting into a water cooled housing. Aperture 7mm diameter defines exposed area of crystal
Mounting	One leadthrough, body diameter 25mm to fit a standard Edwards baseplate and others with 25-27mm hole. Fluoro elastomer O-ring seal
Leak rate	Less than 10^{-9} mbar l sec ⁻¹
Electrical connexion	BNC male 50Ω
Water connexions	Plain sleeve for hose 9.5mm diameter
Water filter	Internal stainless steel 0.75mm mesh in inlet flow connexion
Inlet water temperature	30°C maximum
Outlet water temperature	60°C maximum
Cooling water flow rate	0.25 l min ⁻¹ minimum
Weight	0.5kg net



Ordering information

Model	Ordering number
FTM5 film thickness monitor with mains cable 220-240V/100-120V, 50/60Hz, 50W	21 E086 65 000
FTM5 oscillator with 3m cable	21 E086 66 000
Crystal holder, watercooled with leadthrough and starter pack of 5 crystals	21 E086 67 000
Spare crystals (pkt 5)	21 E086 68 000
Spares kit	14 E086 65 800