The Quantimet
720
Image Analysing
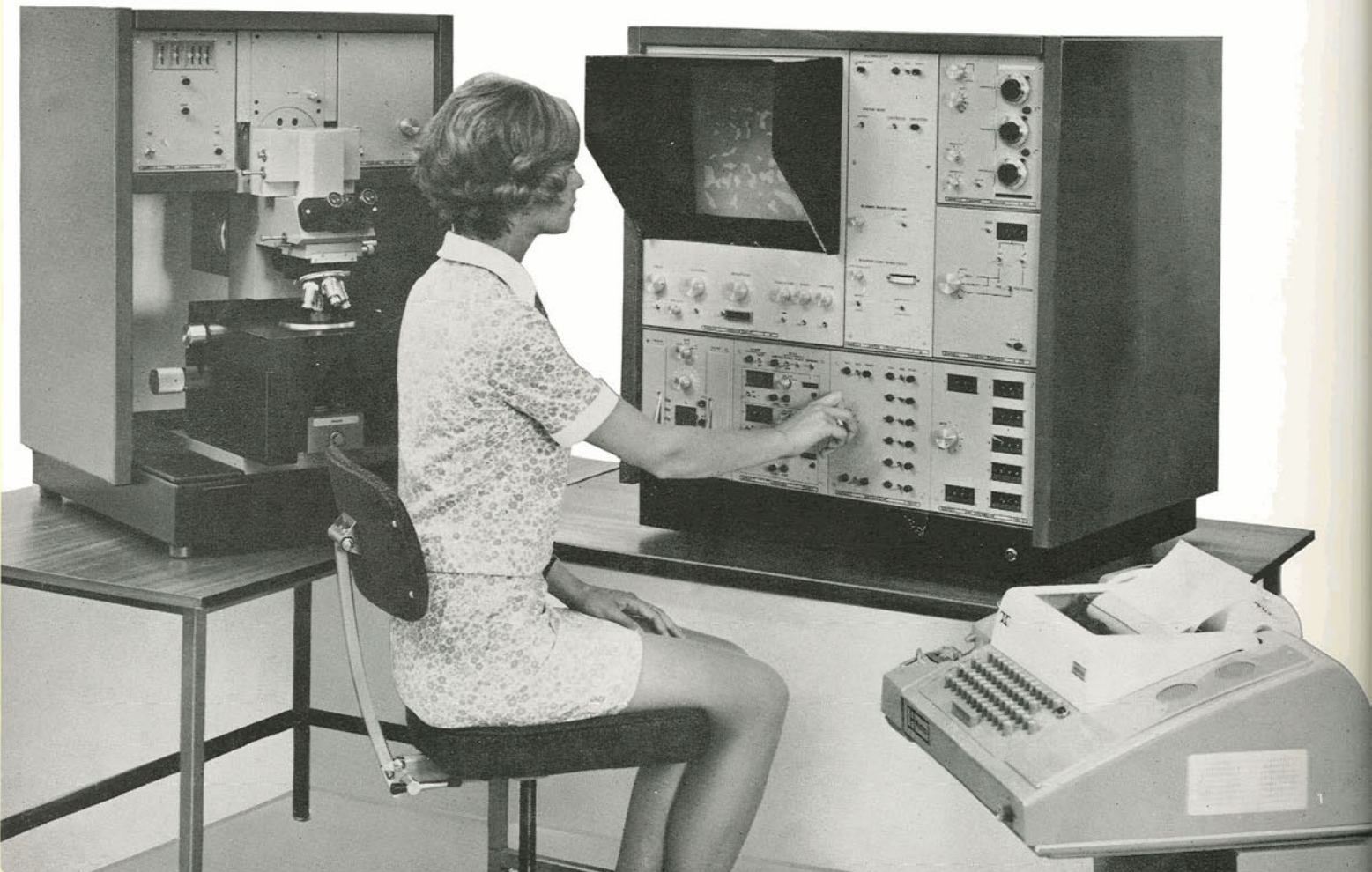# Computer

AUG 2 6 1970

Contents

A high capacity Quantimet 720 installation.

Image Analysing Computers

make automatic assessments of selected features in photographs or in electron, x-ray or optical images, by recognising and isolating such features and then counting, measuring and classifying them. They do this so much more quickly, accurately and reproducibly than human operators that they have made valuable but previously impossible tasks in research and quality control both feasible and economic.

The Quantimet® 720

is based on an entirely new design which embodies experience gained over the past five years from more than 200 Quantimet B installations.

The 720 modules described in this leaflet are parts of a complex, powerful, versatile and wholly integrated image analysis system, capable of both measurement and pattern recognition.

The 720

is built on a modular design allowing the easy addition of many extra modules to an entirely compatible basic system. It

— makes extremely accurate and reproducible measurements.

— offers a choice between radically new, low noise, high uniformity image scanners designed specifically for precision image analysis.

— is digital throughout, ensuring easier calibration and increased stability.

— divides an image into the maximum number of discrete picture points so giving optimal sampling and statistical accuracy.

processes the output of any raster scanning device, including scanning electron microscopes.

provides extremely high-speed performance.

Advances in image analysis technology in the Quantimet 720

The 720 makes several significant advances in the technology of image analysis. *

Optical scanning performance

Two new 720-line Image Scanners, designed specifically for image analysis, allow the best possible scanning performance to be achieved across the whole range of image analysis problems.

The 720 **Vidicon** Image Scanner optimises system performance on images with a wide range between the brightest and dimmest features to be measured and when an adequate amount of light is available.

The 720 **Plumbicon** Image Scanner optimises system performance on images with a narrow range between the brightest and dimmest features to be measured and when the amount of light available is low.

The 10.8 frame per second scanning standard optimises resolution and grey level discrimination on either Image Scanner.

Better counting and sizing logic

The 720 has two counting and sizing modes. It also incorporates a special anti-coincidence point (ACP) counting principle (described below) which eliminates counting and sizing errors made by other scanning instruments.
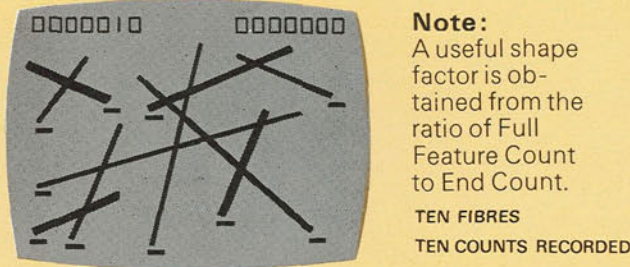
Full Feature Count

Whatever their shape, features are always correctly counted and size distributions are completely accurate even for single fields of view. Some very complex features have a dead-spot paralysis region but this can be shown on the 720 Computer Display and is seldom troublesome.

features

count flags

SIX FEATURES
SIX COUNTS RECORDED
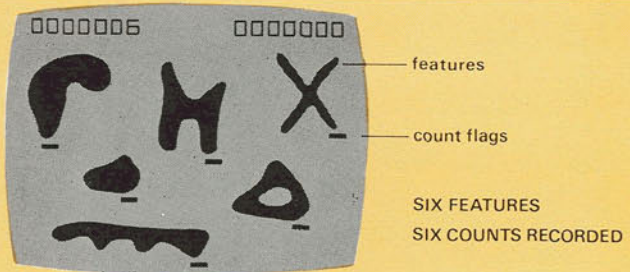
End Count

Overlapping features, like fibres, are counted separately. Size distributions of non re-entrant features are accurate when many fields are averaged. There is no paralysis region but some re-entrant features may be counted more than once.
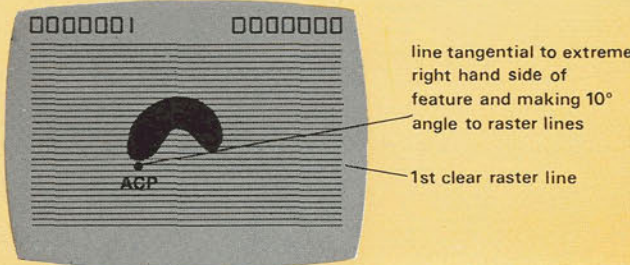
Note:
A useful shape factor is obtained from the ratio of Full Feature Count to End Count.

TEN FIBRES
TEN COUNTS RECORDED

Anti Co-incidence Point Count

A feature is always counted at its anti co-incidence point, or ACP, which is in a fixed position relative to the feature and does not move with sizing. Uncorrectable errors arise when a movable counting point is used, as in some other image analysis systems.
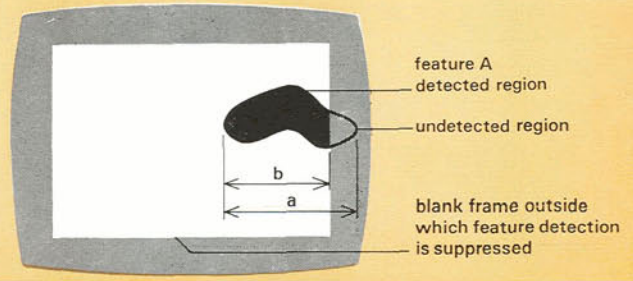
line tangential to extreme right hand side of feature and making 10° angle to raster lines

1st clear raster line

ACP

*The many innovations described in this brochure are covered by British and Foreign patents and patent applications.
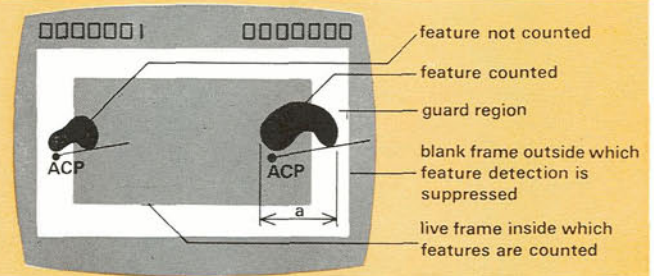
Guard region

Other scanning instruments have had only one mask delineating the area being measured. When features intersect this mask, serious errors are made.

Earlier scanning instruments measure the length of feature A as *b* rather than *a*.

feature A
detected region
undetected region
blank frame outside which feature detection is suppressed

The 720 has an inner mask — the Live Frame — around which is a Guard Region. Both Live Frame and Guard Region are shown on the 720 Computer Display. The computer is able to probe into the Guard Region and measure correctly features which intersect the Live Frame.

The 720 counts features only if their ACP lies within the Live Frame.

feature not counted
feature counted
guard region
blank frame outside which feature detection is suppressed
live frame inside which features are counted

Long features which intersect the Live Frame twice in two adjacent fields are counted incorrectly by other scanning instruments. In the 720, the ACP principle and the Guard Region together ensure that such features are counted and sized correctly, even for a single field of view.

Digital picture point concept

The new 720 scanners are precision measuring instruments rather than mere scanning or viewing devices. Built-in, digital, picture point scan controls, superimpose a matrix of 650,000 precisely positioned fixed picture points. This allows all processing after detection, including sizing, to be digital. Together with their much lower drift and higher linearity characteristics, this enables 720 scanners to achieve the maximum in accuracy.

The fixed picture point scan control of the Quantimet 720 high precision scanners and their higher linearity ensure maximum accuracy — while their low drift characteristics ensure better reproducibility of results and maximise operator convenience.
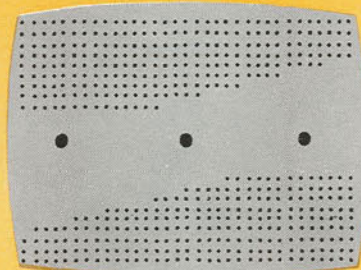
The drifting line scan and lower linearity associated with television cameras give rise to obvious inaccuracies, making results less reproducible and create inconveniences for operators, who need constantly to adjust for analogue drift.
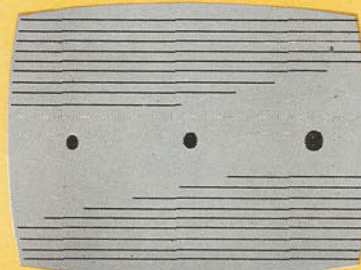
Design of the Quantimet 720

The 720 system is a third generation design by Image Analysing Computers Limited.

It incorporates more than five years' experience on over 200 image analysis installations throughout the world. This experience has been used to define not only performance specifications but also operator needs and reliability and servicing criteria.

The 720 has been designed for ease of operation

The 720 meets the needs of the operator. Although highly complex in concept and powerful in performance, it is easy to understand and easy to use.

A fully integrated modular system

The 720 is a fully integrated, modular, image analysis system. Each module is defined by its image analysis rather than its electronic function.

Each 720 module has the minimum of necessary controls, carefully grouped to make operations easy for the experienced and inexperienced operator alike.

Superimposed displays and read out

The 720 Computer Display presents results just where the operator wants them — on the screen above the image being analysed. It also shows the operator exactly which features are being measured and the parameters in terms of which they are being detected.

Quick and easy programming

Simple programming can be performed by manual switching or by the insertion of plug-in program boards which have previously been set up using screw-in connectors in the matrix. Boards for frequently used programs can be kept permanently plugged up ready for immediate use.

High Level programming involves changes in the relationships between modules, to give a different overall arrangement of the system, and requires changes to be made in interconnections on the High Level program panel at the back of each module. Easy access is provided by the swivelling base on which the 720 is mounted. This enables the operator to turn the instrument through 180°. The hinged back then gives access to the High Level program panels of each module in the system.

The 720 has been designed for maximum reliability

The 720 is mechanically robust, reliable in use and quick and easy to service. Its circuitry is solid state throughout — except for the image tubes — and uses the latest digital computer construction techniques for high performance and reliability.

The 720 measuring the area of the detected features.
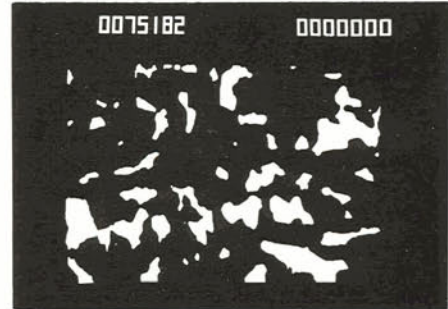
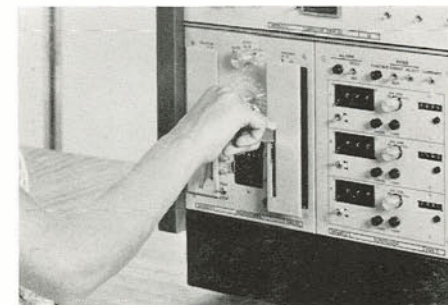The 720 counting the number of features greater than 20 picture-points across.
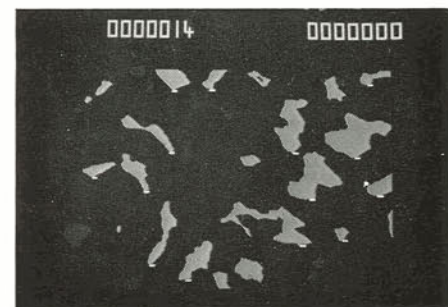
A 720 program board, showing how plugs are screwed into the board to set up a program.

Simple programming; an operator sets up a complex program by inserting a preset program board.

High Level programming; an operator rotates the 720 on its swivelling base and opens the hinged back to change connections between High Level program connectors.
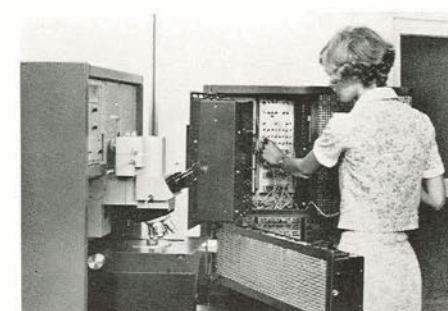
The 720 is accurate, fast and versatile. It ...

Selects and measures features

in PHOTOGRAPHS and RADIOGRAPHS

in images from MICROSCOPES, ELECTRON PROBES, ELECTRON and SCANNING ELECTRON MICROSCOPES

in a variety of objects from BRICKS to BACON and from COAL to CONVEYOR BELTS

Measures the Number, Area and Length of features and classifies them by Length, Area and Shape

Detects maximum number of grey levels

with or without automatic shading correction

Makes extremely reproducible measurements

COUNTS with absolute accuracy

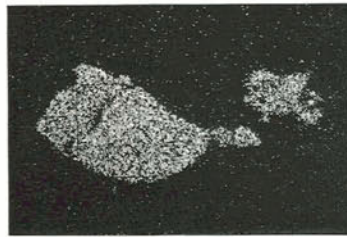SIZES to better than 1% of the maximum field of view

MEASURES AREA to better than 1% for features occupying more than 1% of the field of view

Measures an image in less than 1/10th second

Applications of the Quantimet 720

Materials Science

Applications for Quantimet image analysis systems have been found in most research disciplines and in several areas of quality control and automatic inspection in industry

These pages illustrate applications in the Life Sciences, in Materials Science and in several other scientific and quality control disciplines.

Electron probe microanalysis

X-ray image from analyser showing niobium distribution

White area detected and measured

Area of niobium phase obtained

Metallurgy

Grains in aluminium microsection

Dark boundaries detected, total number of intersects, variation of intercepts with chord size measured

Mean grain size, mean number of grains per unit area and chord size distribution calculated

Metallurgy

Non-metallic inclusions in polished steel microsection

Two types of feature — oxides and sulphides — detected separately ; each type of feature counted and sized, area measured

Mean percent and spatial variation of inclusion content obtained. Size distribution of inclusions calculated

Solid state physics *

Etch lines on thin film electron micrograph

Lines detected and total number of intercepts measured

Dislocation density derived

*Photograph by permission of Chemistry Division, NPL Teddington, England

Mineralogy

Mineral polished microsection

Six phases detected separately, area and total number of intersects measured — up to 25 phases in all can be detected

Percentage and mean size of various phases derived
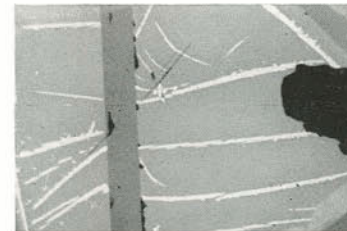
Cement technology •
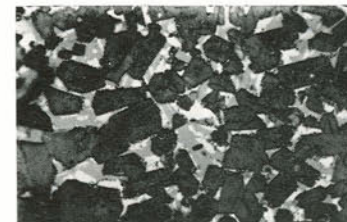
Polished section of cement clinker

All phases detected separately, area and total number of intersects measured

Percentage and mean size of phases derived

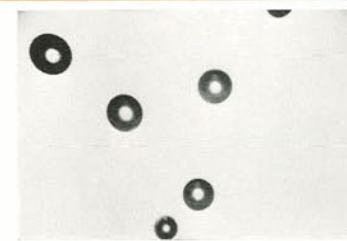*Photograph by courtesy of Building Research Centre, England

Particle size

Dry dispersion of polystyrene spheres

Dark spheres and white diffraction centres detected correctly together, counted and sized

Size distribution derived

Metallurgy

Grains and dark phase in etched steel microsection

Dark area of second phase and grain boundaries detected separately ; area and total number of intersects of second phase measured ; total number of intersects with grain boundaries measured

Percentage of second phase and mean size derived

Mean grain size derived
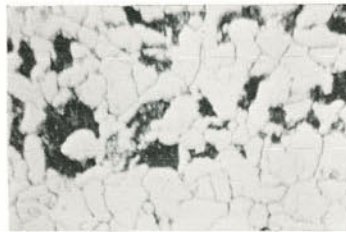
Metallurgy

Non-metallic stringers in polished steel microsection

Dark areas detected either as single features or as agglomeration ; area and size measured

Area and size of individual features making up stringer and total length of stringer derived

Metallurgy

Mixture of porous and non-porous metal fragments in grey matrix

Black and white areas detected. Total white features and features having small black-not-grey-islands counted

Proportion of porous to non-porous metal fragments derived
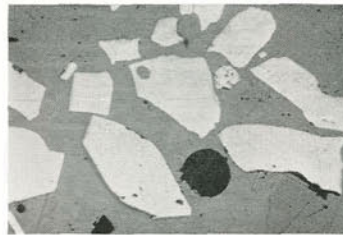
Life Sciences

Biology

Cross section of wood stem showing lumina

White central areas detected, counted and sized, area measured

Size distribution and area percent of lumina derived
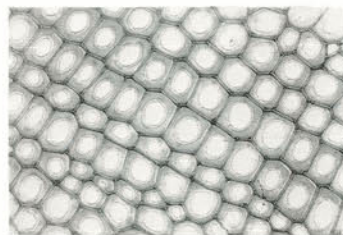
Neurology

Nerve sections showing end plates

Darkest area detected and measured

Area of nerve ending derived

Histochemistry

Non specific esterase in mouse skin

Area of dark stain detected and measured

Effect of esterase quantified

Histology

Carbon particles in avian liver

Dark particles detected , counted and area measured

Spatial distribution of carbon quantified

Autoradiography

Tritiated thymidine labelled cells in rat lung

Dark features detected, counted and area measured

Spatial distribution and uptake of thymidine derived
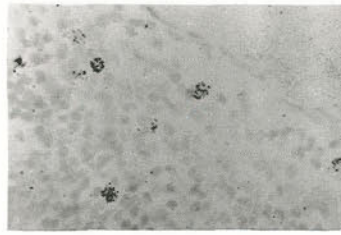
Histology

Goblet cells in rat gut

Dark features detected ; area measured

Percentage goblet cells derived
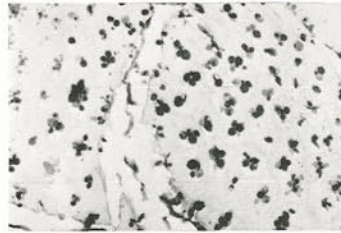
Pathology

Colloid in rat thyroid

Dark area detected and measured

Percentage colloid derived
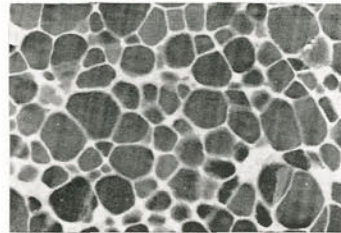
Other Disciplines

Aerosols

Agricultural spray droplets on magnesium oxide

White rings and dark centres detected separately
Number of dark features counted and sized
Number of white rings counted and sized

Size distribution of droplets and coverage of spray
calculated
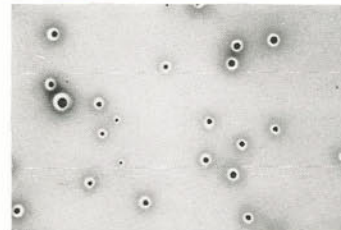
Powder chemistry

Transmission electron micrograph of titanium dioxide

Dark particles detected, counted and sized, total
projection and area measured

Size distribution derived. If distribution law is known,
mean size and standard deviation can be calculated
without sizing
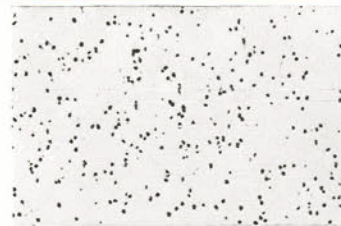
Fibre technology

Dry dispersion of randomly oriented fibres on glass
slide with cover slip

Fibres detected, counted, total intercepts and area
measured

Mean diameter and mean length derived

Fibre re-inforcement

Bundle of aligned composite fibres sectioned at angle
to length

White areas detected, counted, sized

Size distribution of diameters and area derived

Quantimet references
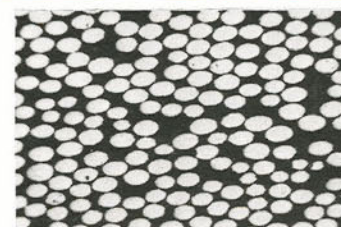
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Quantimet 720 system

a specimen

is imaged by

a **Microscope** (with optional automatic specimen handling)

or an **Epidiascope**

or a **35mm Film Projector** which projects the image on to

the **720 Vidicon or Plumbicon Image Scanner** whose output — or that from a self scan system — is passed to

a **720 Detector** which selects the features to be measured and passes pulses from these to

a **720 Amender** which allows modification or 'amendment' of detected signals before they are passed on to

a **720 Computer** which measures the number, area and length of the features selected and classifies them by area, length and shape

a **720 Display** shows the features being measured, provides special computer displays and presents accumulating digital displays of measured parameters

alternatively or additionally results can be passed to one of the several **720 Data Processing Systems** (e.g. teletype, desk top computer, etc). or to a **720 Supervisor** module

the entire process can be automatically controlled by a **720 Programmer** or can be manually controlled by switches.

Description of the Quantimet 720
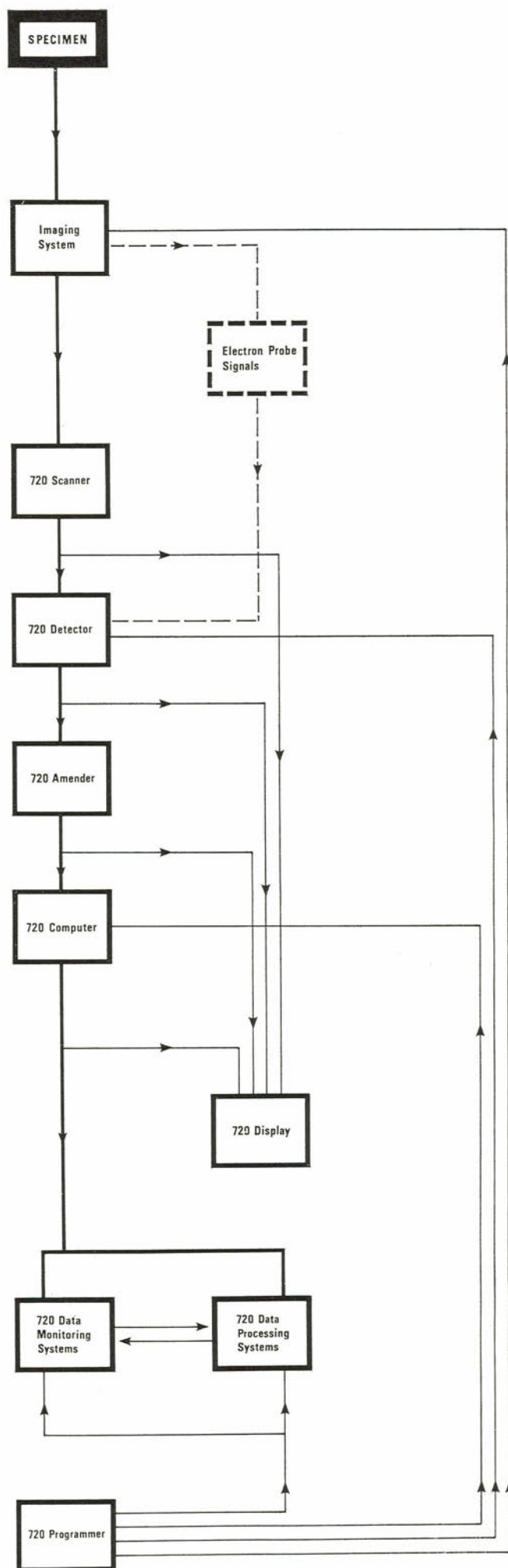
The title of each 720 module defines its basic function. Some modules however have been designed in alternative versions so that a choice can be made of the most appropriate for a given speed or other requirement. For example ; the M series of any module gives the best in resolution and grey level discrimination : the S series gives the best performance when slow speeds only are required — as, for example, with scanning electron microscopes and stage scan systems.

Individual 720 Data Sheets — available on request from Image Analysing Computers — describe in detail the performance specifications of each module and the alternative versions of each module.

Imaging and Scanning Devices

The 720 Microscopes have all the usual research microscope facilities. The Microscope Stage can be programmed to give controlled steps in 'X', 'Y' and 'Z' directions. For large objects and photographs a specially designed Epidiascope is available.

The new 720 Vidicon and Plumbicon Image Scanners convert the image into the signals required by the 720 Detector (see below). These new Image Scanners are designed specifically to meet the requirements of precision image analysis, with special scan standards, digital scan control, very low noise and many other unique features. A 720 line scan system is used, with no interlace, and with a frame repetition rate of 10.8 times per second. Additionally an Automatic Shading Compensator corrects for variations in image tube response and background light levels and allows uniform detection over the whole image.

720 Image Scanners can be fitted to all types of light microscope and to most types of electron microscope and 35mm film projector. Scanning electron microscopes, microprobe analysers and other slow scan devices can be coupled directly into the 720 system through the System Interface Module and do not require an Image Scanner.

Detectors and Amenders

The 720 Detector selects features for measurement according to their grey levels. Its resolution control allows scratches and other incidental features to be counted or ignored at will and enables the best compromise to be made between resolution and grey level discrimination. A Ground Cut Control minimises the effects of gradual changes in background intensity when, for example, very thin features need to be picked out from an uneven background.

The 720 Amender enables an operator to suppress or stretch detection to vary slightly or to 'amend' the detected image, e.g. to fill in white holes in a feature which should be consistently black or to agglomerate adjacent features (for treatment as one larger particle of the size of envelope surrounding the selected features).

Computer and Display

The 720 Standard Computer counts features and intercepts, measures area, and makes size distributions in radically new and useful ways. It can also be used to classify features by other visual criteria.

The precision 720 Display shows a 720 line picture and has comprehensive facilities for mixing the video signals to monitor the operations of the system. It also displays the results of the measurements being made in two accumulating digital displays, which appear above the picture on the monitor screen itself, where they are easy and convenient to read. The Guard Region around the Live Frame is also displayed and there is provision for electronically superimposing a calibration scale.

Programming and Data Handling Systems

Programming the simplest 720 system involves no more than turning a switch and writing down results shown on the screen of the 720 Display.

For more complex problems a special 720 Programmer is provided, which sweeps the controls through all the required parameters on each field of view. Measurements are then recorded and analysed rapidly and automatically by one of several alternative data handling and printing systems, before the computer controlled stage moves to the next field of view.

The program is defined by a plug-in matrix board. Any required program can be easily and rapidly set up by screwing plugs into appropriate positions on the board. Program boards can be changed in seconds and a complex program set up in no more than a few minutes.

High Level programming involves rearrangements of interrelationships between the image analysis modules in the system in order to obtain different overall computer characteristics. New modules can be added or interrelationships between existing modules changed to provide the program best suited to a particular problem — e.g. to provide higher speeds, further discrimination, etc.

Special purpose connections allow certain advanced multiphase analyses to be made and, when combined with special purpose modules now in development, will enable the system to make judgments based on pattern recognition criteria.

8 System schematic

SECTION 1: IMAGING AND SPECIMEN HANDLING SYSTEMS

SPECIMEN

Scanning Electron Microscope, Micro analyser, Stage Scan System or other external Scanner or conventional T V Cameras

Transmission Electron Microscope, Telescope, Special Light Microscope or other external Imaging System

35mm Film Projector

Epidiascope

Unstabilised Power Supply

Stabilised Power Supply

Unstabilised Power Supply

Stabilised Power Supply

W. Halogen Lamp

C.S.I. Lamp

Transmission Microscope

Universal Microscope

Incident Microscope

Microscope Accessories

Manual Stage

Automatic Stage

X & Y Stage Control

Z Stage Control

Image Rotation Control

SECTION 2: IMAGE SCANNING SYSTEMS

Plumbicon Scanner Head

Vidicon Scanner Head

System Interface

Plumbicon System Control

Vidicon System Control

Automatic Shading Correction

Display

SECTION 3: IMAGE PROCESSING SYSTEMS

Notes:

1 More than one module of any type can be used for almost any combination of series/ parallel operation.

2 Any solid line-path from SPECIMEN to RESULTS is a viable system.

Variable Frame and Scale

Standard Detector

Special Detectors

Co-ordinate

Densitometer

Amender

Size Distributor

Variable Frame and Scale

Special Computers

Standard Computer

Size Distributor

SECTION 4: PROGRAMMER

Programmer

SECTION 5: DATA HANDLING FACILITIES

Teletype Drive

Supervisor 1

Supervisor 3

Accumulator Display

Multiple Accumulator

Others on request

Calculator Drive

Digital read-out on S.E.M. monitor

Teletype

RESULTS

Calculator

Digital read-out on display screen

Description of 720 modules

Modules shown opposite in black are in production and those in colour are under development. Each module is described and specified in more detail in the relevant Data Sheet:

Section 1: Imaging and Specimen Handling Systems

	Data Sheet
	7200/9
Microscopes incident transmission and universal research microscopes with all the normal research microscope facilities, power supplies and light sources.	7201/1 7201/2
Microscope stages and controls — Manual and Automatic Stages. — Stage X and Y Control. — Stage Z Control.	7202/1 7202/2 7202/3 7202/4
Epidiascope for imaging photographs, bricks and other large objects.	7203
35 mm Film reader for projecting 35mm film.	7204
Image rotation control for automatic rotation of the image scanning tube for perfectly centred image rotation.	7205

Section 2: Image Scanning Systems

	Data Sheet
	7210/9
System interface interfaces with scanning electron microscopes and other scanning instruments, including television cameras, with display mixer, accepts shading corrector.	7211
Scanner heads new Plumbicon and Vidicon Image Scanners.	7212
System control accepts shading corrector and includes data accumulator and system mode control.	7213
Display for monitoring the image and computer operation and displaying the results — includes display mixer.	7214

Section 3: Image Processing Systems

	Data Sheet
	7220/9
Detectors Standard Detector. Special Detectors.	7221
Amender for filling in gaps in features, agglomerating clusters as single features, simple chord size distribution, etc.	7222
Computers Standard Computer measures 'full feature' and 'end' counts, intercept and area size distributions. Special Computers.	7223
Variable frame and scale for varying the live or blank frame. Also provides precision graticule scale for direct manual measurement.	7224

	Data Sheet
Size distributor for sweeping through eight size ranges automatically.	7225
XY Co-ordinate feeds out XY co-ordinates of every detected or computed feature.	7226
Densitometer for feature specific scanning microdensitometry.	7227

Section 4: Programmer

	Data Sheet
for programming the 720 to sweep through range of measurements automatically — 16 or 32 instruction modules available.	7230/9

Section 5: Data Handling Facilities

	Data Sheet
	7240/9
Analyser for measuring the ratio of two parameters on each feature and classifying by this ratio.	7241
Accumulator display for displaying results in systems without the Display	7242
Supervisors for accepting or rejecting fields of view when they exceed preset values of various parameters. One and three criteria versions available.	7244
Multiple accumulator for rapidly accumulating up to eight information channels for subsequent read out channel by channel of the total on the monitor or other digital display.	7245
Calculator drive interface module between the 720 and the calculator.	7246
Calculator for carrying out further data processing and recording results.	7246
Teletype drive interface module between the 720 and the teletype.	7247
Teletype for printing out results and preparing punched paper tape.	7247

Choice of the most cost effective Quantimet 720

There are up to 1,000 possible variations in the assembly of a series of 720 modules. Selection of the most suitable configuration is therefore a question primarily of value analysis i.e. of selecting the system which can solve a problem with maximum versatility at minimum cost.

Image Analysing Computers will be pleased to offer advice on systems most appropriate to the solution of any particular image analysis problem. A preliminary selection can however be made from the descriptions of modules on p. 9 and the diagram on p.8. Please note that in using the diagram on p.8 it is necessary to complete at least one solid line between SPECIMEN and RESULT.

Three typical 720 systems

Three typical 720 systems, drawn from the diagram on p.8, are described. The first is a simple, manually operated system ; the second a system with some automatic operation and the third a fully automatic system. Converting the first or the second to the third involves no more than purchasing the extra modules required and simply plugging them into the existing system.

System 1

A simple manually operated system with minimum data read out.

Section 1
Imaging and specimen handling modules
User's own microscope with manually traversing stage and non stabilised power supplies

Section 2
Image scanning modules.
720 Vidicon Image Scanner with system control
720 Display

Section 3
Image processing modules
720 Standard Detector

Section 4
Programming modules
None : system is operated by switches

Section 5
Data processing modules
None : results are given on accumulating numerical displays on the 720 Computer Display

Notes on System 1

Measurements
Area and number of intercepts.

Advantages
Simple and inexpensive.

Disadvantages
External power must be stable ; microscope must have even illumination and correct alignment ; data acquisition and read out facilities are limited ; grey level discrimination is limited unless 720 Automatic Shading Compensator is added ; Live Frame is fixed.

Speed
Measurement of area and projection for 100 fields takes no more than 40 minutes. Accumulating area or projection alone, for 100 fields, takes no more than 15 minutes.

System 2

A more powerful system with some data handling facilities

Section 1
Imaging and specimen handling modules
720 Universal Microscope

Section 2
Image scanning modules
720 Vidicon Image Scanner with scan control
720 Automatic Shading Compensator
720 Display

Section 3
Image processing modules
720 Standard Detector
720 Amender
720 Size Distributor
720 Standard Computer with Variable Frame and Scale Module.

Section 4
Programming modules
720 16-instruction Programmer

Section 5
Data processing modules
720 Accumulator

Notes on System 2

Measurements
Area, number of intercepts, count (two modes) and size distribution, on all four parameters.

Advantages
Handles all System 1 measurements and provides additional count and sizing facilities.

720 Amender allows both 'correction' of detected features and agglomeration of adjacent particles into one feature ; 720 16-instruction Programmer with 720 Accumulator allows automatic sweep through 16 parameters in 0.4–1.6 seconds and instantaneous accumulation of results on several fields of view ; fully variable Live Frame allows selection of any part of field ; X and Y scale allows precise measurement of features ; automatic shading correction gives very high grey level discrimination and correspondingly greater accuracy.

Disadvantages
Stage must be moved manually ; operator required during entire period over which measurements are being taken ; no data print out or processing facilities ; no record of measurements on individual fields of view.

Speed
Measurements of area and of number in six different size ranges are accumulated over 100 fields in no more than 6 minutes — or 3.6 seconds per field of view.

System 3

A fully automatic 720 image analysis system

Section 1
Imaging and specimen handling modules
720 Universal Microscope with stabilised power supply and 'X' and 'Y' Automatic Stage and Control Module
720 Epidiascope
720 Image Rotation Control Module

Section 2
Image scanning modules
Two 720 Plumbicon Image Scanners with Automatic Shading Compensators
720 System Interface Module
720 Display

Section 3
Image processing modules
720 Standard Detector
720 Amender
720 Size Distributor
720 Standard Computer
720 Variable Frame and Scale Module

Section 4
Programming modules
720 16-instruction Programmer

Section 5
Data processing modules
720 Supervisor Module
720 Teletype Drive Module and Teletype
720 Accumulator

Notes on System 3

Measurements
Area, number of intercepts, count (two modes) and size distribution on micro and macro specimens.

Advantages
Two scanning heads allow quick changeover from microscope to epidiascope, automatic stage control allows measurements on up to 1,000 fields of view automatically in 17 minutes, i.e. at one field per second ; 720 Image Rotation Control allows measurements for anisotropy ; 720 Supervisor Module allows setting of three critical parameters which, if satisfied alone or in combination, stop the instrument with visible or audible warning signals, recording automatically all fields in which critical parameters are exceeded ; Teletype prints out data for reading or feeding into a general purpose computer ; measurements are made entirely automatically, so freeing up operator time.

Speed
Similar measurements to those made with a System 2 configuration are recorded — using the 720 Accumulator — in 3.5 minutes (vs. System 2 — 6.0 minutes) ; using the 720 Teletype Drive Module and Teletype — in 16 minutes.

Note: the pattern recognition capability of all the above systems will be considerably expanded by 720 modules now in development.

Overall specification of the 720 system

The full specification of all the 720 modules is set out in individual technical Data Sheets (see page 9)

Resolution

in dimensions — from a few Angstrom units upwards depending on the imaging system
in lines — 720 lines scan sampled to give 890 picture points horizontally
in picture points — 650,000 square picture points cover the image (the picture point is 10% smaller than the scanner resolution thus utilising the full scanner performance).

Grey level discrimination

Measured on uniform specimen with a live frame of 5×10^5 picture points and threshold limit at 5% breakthrough using standard detector.

		720 Vidicon Scanner		720 Plumbicon Scanner	
		with shading corrector	without shading corrector	with shading corrector	without shading corrector
Full Resolution	720 M Series	15	7	12	6
Quarter Resolution	720 M Series	25	8	18	7
Eighth Resolution	720 M Series	30	9	25	9
Eighteenth Resolution	720 M Series	30	9	30	9

The discrimination of the S series is governed by the characteristics of the particular external scan system selected

ALL PERFORMANCE FIGURES ARE PROVISIONAL

Speed

	720 M System
in picture points/second	8×10^6
time taken to scan 1 field	.09 secs.
maximum number of field/second	1

Linearity

Scanner: 1% Absolute Position   **Display:** 1% Absolute Position

Accuracy

This is a function of feature geometry, contrast and its size at the scanner. Taking fixed feature positions to avoid shading errors, standard deviation between ten operators using standard detector for round features is:

Contrast%	Area%	Area accuracy% measured value	Count accuracy
100	10		Exact
100	1		Exact
30	10		Exact
30	1		Exact

Dimensions

Central Processor

Width: 80cms. Depth: 60cms. Height: 60cms, 82cms, 104cms, depending on number of decks. Weight: 60 kilos monitor deck + 30 kilos for further 4 module deck + weight of modules.

Microscope and Plinth

Width: 60cms. Depth: 70cms. Height: 82, 104cms depending on number of decks. Weight: 80 to 160 kilos depending on auxiliary equipment.

The Quantimet 720 is manufactured by Image Analysing Computers Limited at their factory in Cambridge, England.