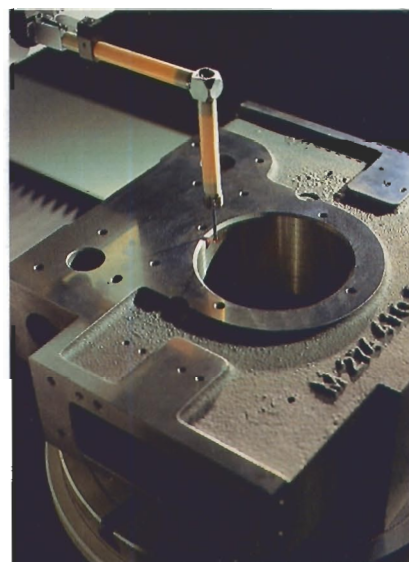


**The EMZ series:
CNC controlled
4 and 5 axes
inspection cen-
ters for gears
and rotary parts**

Highly flexible inspection equipment for modern manufacturing

The EMZ is not only the ideal means for inspecting cylindrical gears, it also fulfills all the demands of a universal measuring machine.

In addition, you can integrate the EMZ into an automatic production process at any time.



Prismatic parts can also be measured easily.

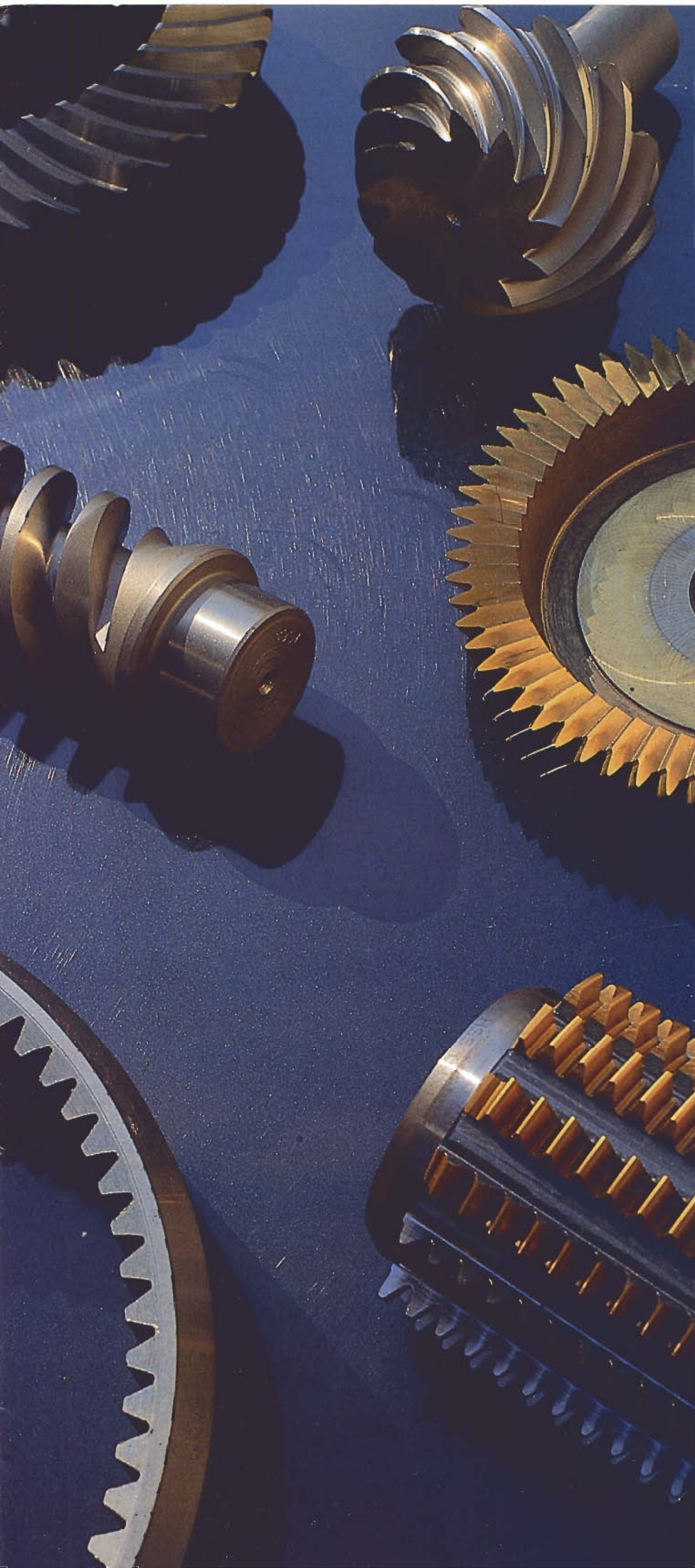
VERSALITY IS THE UPPERMOST REQUIREMENT.

Besides external and internal cylindrical gears, the EMZ can measure any 3-D surfaces which can be kinematically produced on workpieces. A new generation of controller also enables Carl Zeiss measuring software modules to be run. The EMZ is thus also suited for general coordinate and curve measurements on rotary parts. With automatic scanning of unknown contours, the EMZ fulfills the highest demands of versatility and flexibility.

SHORT MEASURING TIMES. The control and computer guarantee fast inspection runs, so that measurements are extremely efficient. The robust construction and the mass to be moved help to achieve highest measuring and positioning speeds. And the simultaneous evaluation procedure with inspection sheet output reduces to a minimum any manual documentation.

ERGONOMIC OPERATION. The EMZ is simple and safe to operate due to the dialog-oriented user instructions. The user interface is self-explanatory; the operator must also confirm manual tasks in dialog with the computer. The working area is designed so that all manually operated parts are close at hand.

HIGHEST PRECISION. The EMZ is distinguished by extremely high accuracy. The EMZ inspects gears with a measuring uncertainty of only 1 μm . Axis positioning is measured with a resolution of 0.1 μm linear or 0.36" rotary.



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The
machine concept

4 or 5 CNC axes for the largest flexibility

The EMZ gear inspection centers are specially designed for universal testing of all kinematically developed 3-D surfaces on workpieces. The inspection centers are in use with gear and transmission manufacturers and throughout the machine building industry.

Even **large gears** can be inspected with ease.



The tailstock slide. You clamp and adjust the slide manually. When traversing the slide, it lifts completely from the reference surfaces. Due to its weight compensation, you can slide it very easily and absolutely free of wear. Optionally, the slide can also be ordered with a motor drive.

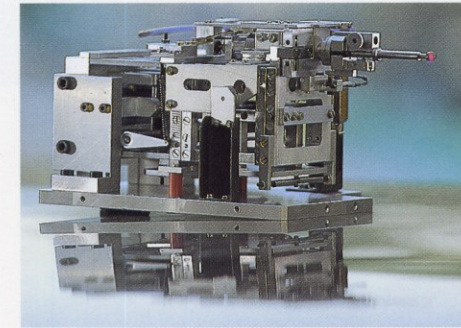
The C axis. It is integrated in the machine table and is supported by highly precise, pre-loaded bearings. The friction drive with its fast-reacting servomotor and an incremental rotary encoder sitting directly on the shaft ensure exact axis positioning and adjustment.

The equipment base. The base is a strongly ribbed iron bed. The construction is optimized for stability and guarantees greatest possible rigidity. The bed contains no mechanical or electrical components to prevent heat emissions.



a UNIQUE SYSTEM. The EMZ are a range of extremely sturdy universal inspection centers for measurements on testpieces up to 2600 mm diameter. Four or five CNC controlled axes enable you to comfortably test practically all varieties of gears and many tools and rotary parts. In addition to our proven software packages, the most important modules of the Carl Zeiss measuring software KUM, GON, UMESS and RAM can now be integrated.

THE MEASURING PROBE SYSTEM. The 3D measuring probe is a collision protected probe. The different probe weights are automatically compensated by the computer. The stylus is calibrated one time automatically on a standard ball gauge, and the calibration data is stored. Thereafter, no recalibration is needed at stylus change: the data is loaded automatically. The 3D measuring probe enables automatic feed-in to the first tooth gap.



The Z column. The entire Z column can be traversed in the Y direction. It carries the Z and X slides, as well as the Y measuring axis on large machines, in highly accurate guides. Due to our use of the transverse generating technique, the X axis is kept very short for greatest accuracy.

The control console. You can safely drive the CNC axes using the joysticks on the manual operating panel.

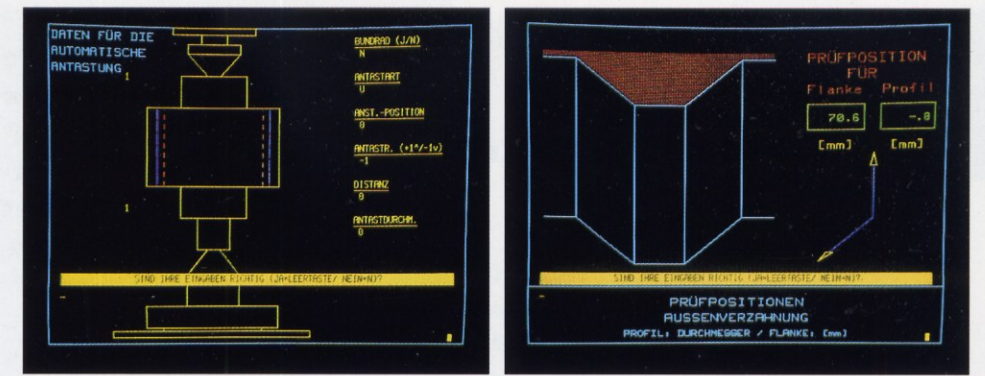
The computer unit. This unit is comprised of a PC integrated in the control cabinet, or alternatively a HP workstation. The graphic user instructions permit easiest operation.

Fully automatic documentation. The plotter, as standard equipment, outputs the appropriate inspection sheet parallel to the measurement – especially important for measurements with documentation requirements.

Simplest measuring with CNC

The EMZ is distinguished by its extremely simple operation. The easy to understand user interface guides the operator interactively on the screen through the entire inspection process and the manual tasks.

The graphic user interface is in color. The operator is guided through the input and testing procedure by an interactive dialog. The graphics and plain language specifications shown here make the EMZ easy and comfortable to operate.



THE USER INTERFACE. The EMZ user interface is designed according to state of the art didactic methods in the menu technique. You carry on a dialog with the computer during the inspection process via keyboard. You are supported by icons, graphics and function keys. Both the plain language specifications and the color highlighting of the menu lines make program operation simple and comfortable.

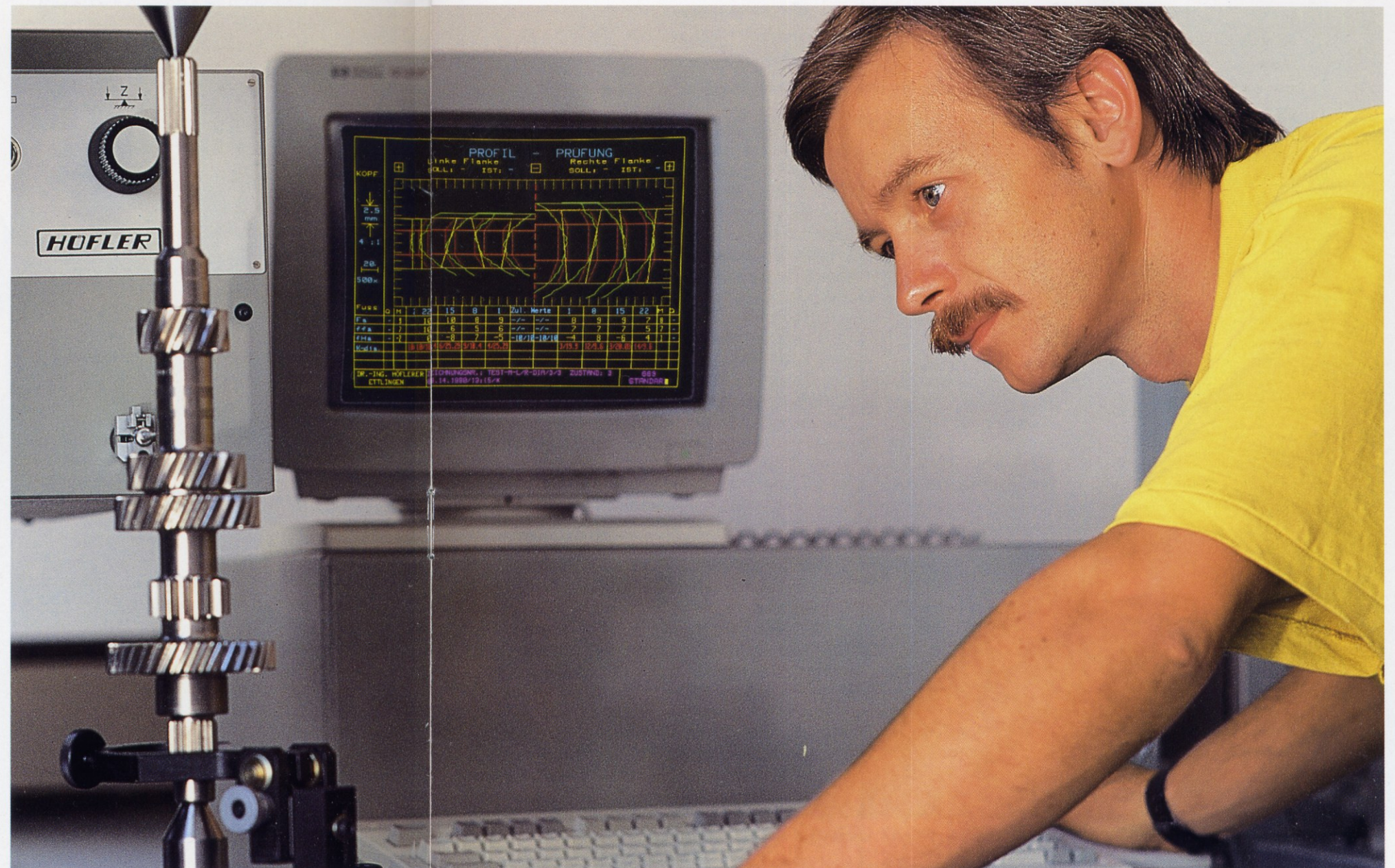
DATA INPUT. In dialog with the computer, the nominal gear data is either input from the production drawing or loaded directly from an existing file. Here you also specify the different measuring parameters such as the test positions and type of positioning, along with the evaluation parameters.

CALL THE MEASURING PROGRAM. Specific programs for generic parts are at your disposal. Due to the software design, you only have to call the type of inspection, e.g. profile, lead, pitch and runout or any combinations. The measurement runs completely automatically.

CLAMPING THE TESTPIECE. You set-up the test piece between the centers. Then you affix the driving dog and start the measurement.

EVEN FASTER WITH SERIES MEASUREMENTS. If you have constantly recurring part families, you can reduce your input times again drastically: Activate the serial measurement module for identical types of workpieces, and avoid entering additional workspecific parameters and evaluation criteria.

Start the measurement after clamping the testpiece. Feed-in of the 3-D measuring probe is **fully automatic.** The inspection also runs automatically.

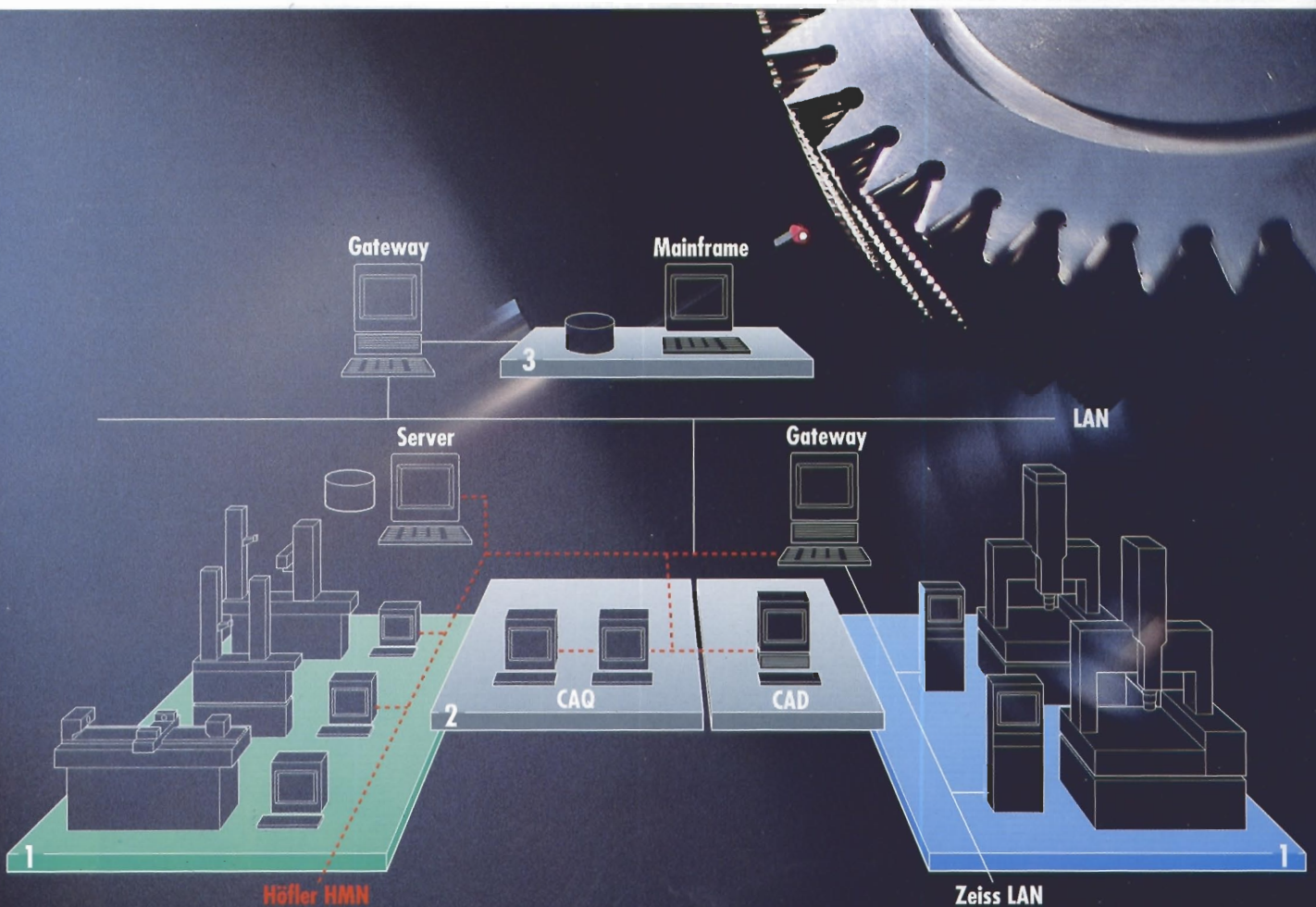


Control, software,
networking

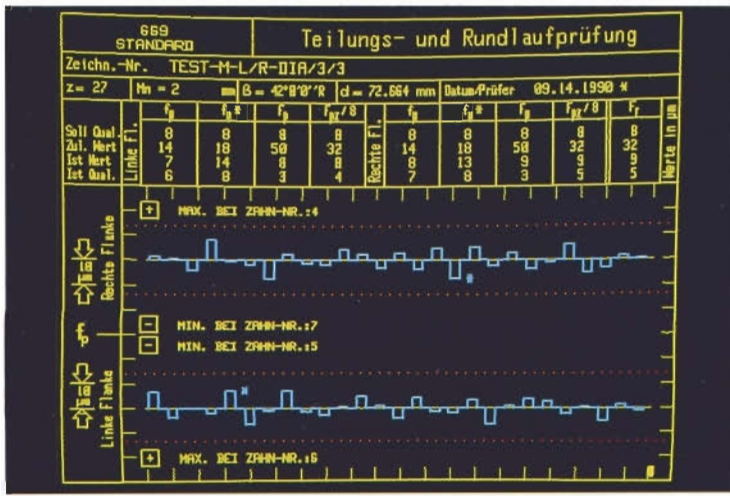
Simply ingenious, ingeniously simple – the computer concept

A powerful computer system controls all actions. All menus can be quickly and comfortably clicked on the screen via interactive graphics, function keys and trackball. Integration in the HMN permits realization of a centralized network.

The **HÖFLER measuring network** HMN permits central management of all your measurement data.



1 Workshop level 2 Quality control level 3 Production control level



The results of the **pitch and runout test** are displayed on the screen in color immediately after the measurement.

THE COMPUTER CONCEPT. Both the control and the measuring and evaluation software of the EMZ are completely new designs for an IBM compatible PC. The proven HP workstation is also optionally available. The integrated HOFLER 32-bit system is a computer concept which leaves no wishes for speed and operating convenience unanswered.

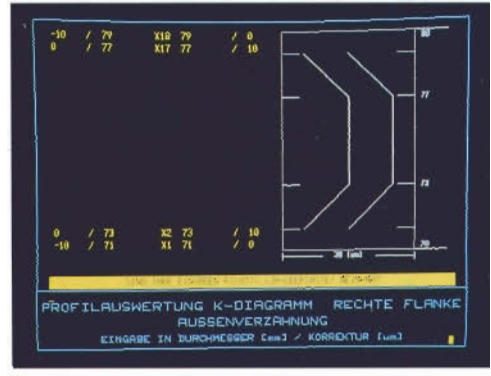
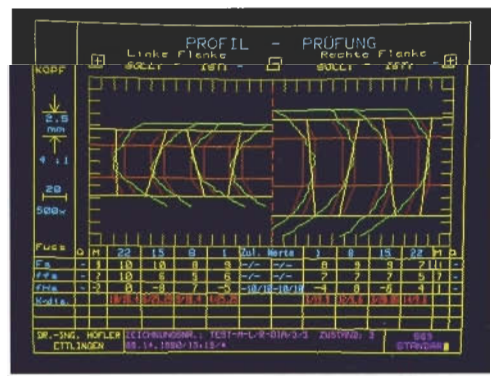
THE CONTROL. The control is comprised of one 16/32-bit 5 axes CNC measuring control which is connected to the computer system via a fast parallel interface. This enables data to be transferred substantially faster than with a standard RS-232 interface. This control module also allows selected program modules of the Carl Zeiss measuring software to be run.

THE SOFTWARE. Comprehensive standard and special software is at your disposal for measurement and evaluation. In addition to the complete measurement of cylindrical gears - profile, lead, pitch and runout in one mounting - you can comfortably inspect bevel gears, worms, hobs and much more. In addition to running the CARL ZEISS measuring software modules from KUM, GON, UMESS and RAM, the EMZ also scans and identifies unknown profiles, giving it unsurpassed universality. You can significantly reduce time consumption by testing entire work batches in series according to company-specific standards. You can also save considerable time by measuring spur gears in a cluster or on gear shafts without interrupting the automatic measurement.

EVALUATION OF THE RESULTS. The evaluation is carried out according to DIN or AGMA, so no interpretation problems can arise. The inspection sheet gives you exact information on deviations, variations and trends. A number of additional company-specific evaluation modules are available.

NETWORKING. This is the future of modern data handling. You can therefore integrate the EMZ into the "HOFLER Measuring Network" (HMN). Within a CAQ environment, the current measurements can be sent back to production for split-second feedback to correct the machine setting. HMN is even more important for central data management: data in- and output is performed centrally to minimize standstill times on the measuring machine. Link-up to foreign networks is also possible because the HMN is based on a standardized LAN design.

When evaluating the **profile test**, you can read the results for the right and left flanks simultaneously - even in different scales. You can also generate a **K-chart** - with thirty six programmable corner points.



All gear types can be measured – and much more

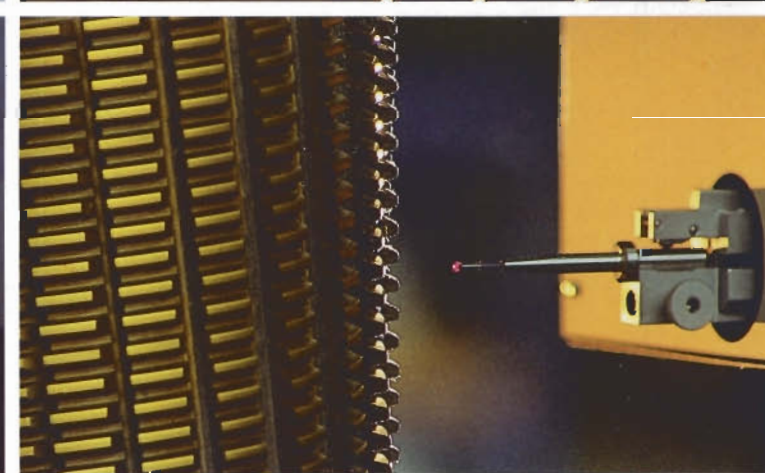
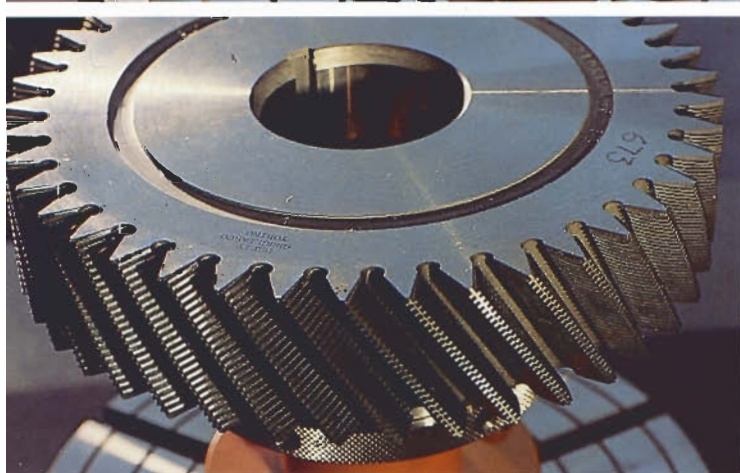
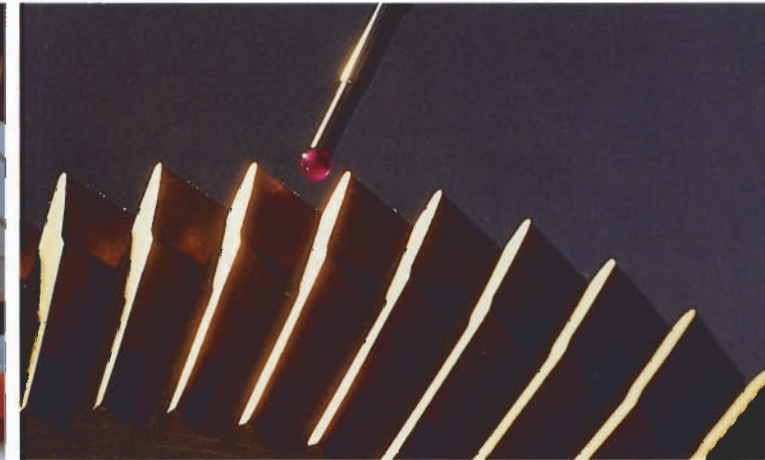
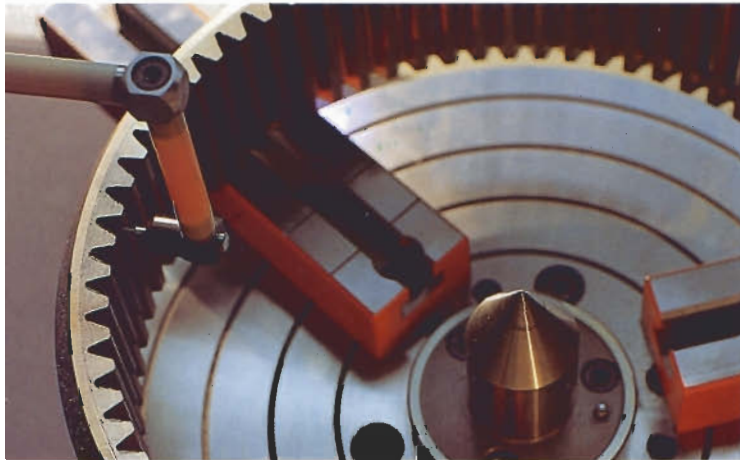
The applications of the EMZ are highly diverse. The comprehensive software enables you to inspect the most varied types of gears and many tools.

THE VERSALITY OF THE EMZ knows no limits. We have easy to operate measuring software in our program for the multitude of workpieces listed below, but this is only a small fraction of our offering, and we are constantly developing new software modules.

1 INTERNAL CYLINDRICAL GEARS. The cylindrical gear inspection software measures the tooth flanks according to DIN, AGMA or other standards as desired. Profile, lead, pitch and runout can be tested in one mounting. Crowned tooth flanks and tip and root reliefs can also be evaluated.

2 SHAPING CUTTER INSPECTION. The shaping cutter inspection is performed for profile lead and pitch deviations. Different auxiliary measurements, e.g. tip probe correction angle, rake angle and many more are possible.

1 2



3 4

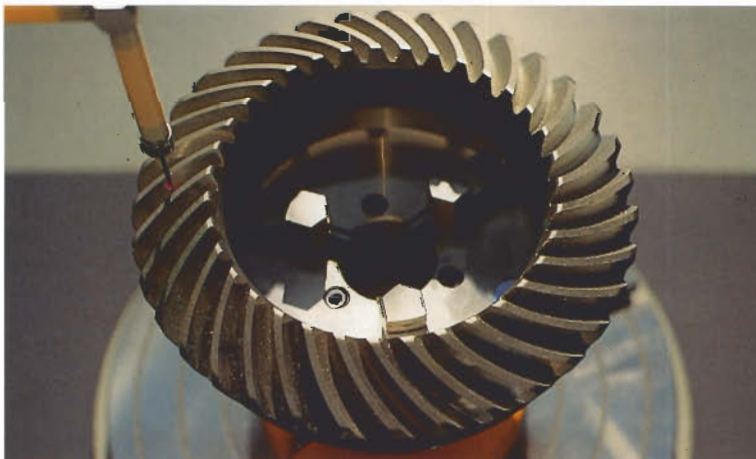
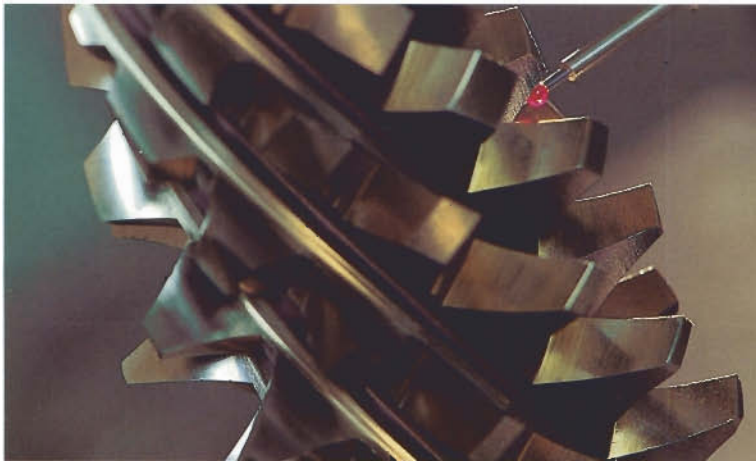
3 SHAVING CUTTER INSPECTION. The program is designed for straight and spirally fluted test pieces. For the profile test, e.g. one evaluation range can be defined for the active involute and another for the tip or root relief. The angle deviation, amount of negative crowning and difference between the greatest and smallest angle deviation are output for the lead test. The pitch can also be measured.

4 HOB INSPECTION. This software measures single and multi-threaded hobs for the production of cylindrical gears with involute profiles. One module tests the geometry and a second checks the resharpening parameters. The geometric parameters according to DIN or AGMA are determined by one inspection routine. A short program only measures and evaluates the parameters which are relevant after sharpening.

5 TAPERED HOBS. One of a kind: inspection of multi-threaded hobs which do not have a complete thread. The software generates a procedure with "probe jumping". The teeth are probed in different threads, giving a complete revolution.

6 WORM GEARS. The software measures the profile and lead of the worm. The program also evaluates the thread pitch or circular pitch on worms with the most varied profiles.

5 6



7 8

7 BEVEL GEAR INSPECTION. This software package performs the flank and pitch test on straight, skew and spiral bevel gears. The measurements are acquired with the scanning technique based on functional dimensions.

8 INSPECTION ACCORDING TO THE MASTER GEAR METHOD. The nominal geometry of a tooth is acquired in isometric form as a grid. Form deviations are entered perpendicular to the grid. Pitch can be measured optionally in the same inspection procedure.

The new control generation

Even more versatile with the scanning function

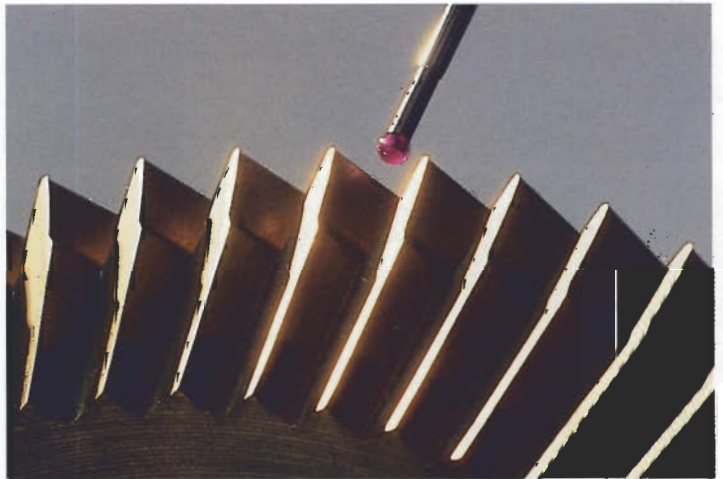
The EMZ series of inspection centers has been equipped with a new control that also runs the proven CARL ZEISS measuring software.

THE IMPROVED CONTROL. The new control adds three techniques to its measuring capabilities, opening even more fields of application for the EMZ.

DISCRETE POSITIONING. Discrete single points are measured with this technique. They are connected mathematically to a curve or any other geometric element.

SPECIFICATION OF A NOMINAL PATH. This method allows you to specify a nominal path which is derived from the tooth geometry as a mathematical model. The probe directly records the deviation while tracing this path.

CONTOUR SCANNING. A special function of the EMZ inspection centers is contour scanning. It enables you to digitize real 3-D workpieces. You generate a data record which is acquired as an actual value and then converted mathematically to the nominal value. You then use this nominal value to measure the following series. The wobble axis correction is performed automatically with this technique. Contour scanning is especially well suited for digitizing unknown curves.



Conscientious documentation and reliable statistics – generated concurrently

The EMZ fulfills the increasing demands of documentation. The inspection sheet output is automatic. We also offer comfortable software for statistical evaluation.

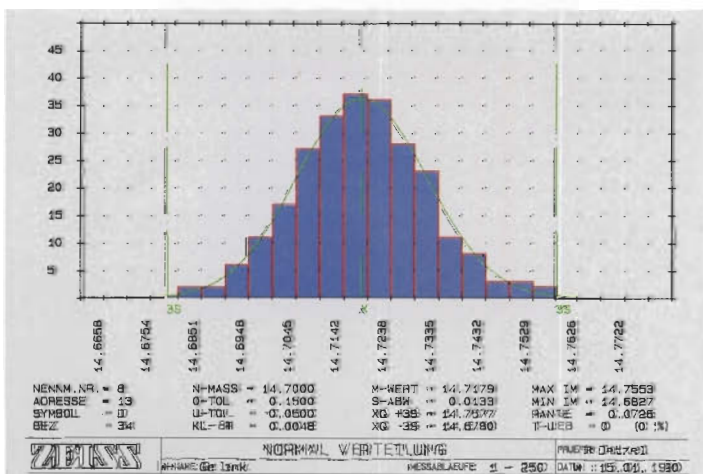
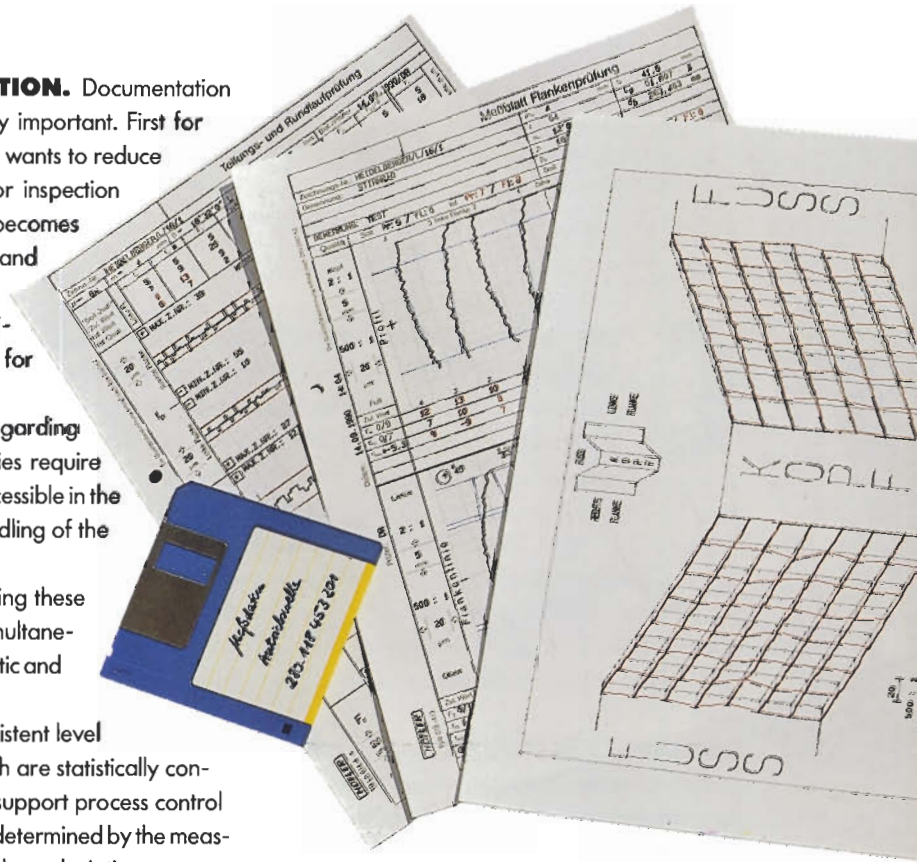
COMMITTED TO DOCUMENTATION. Documentation of the measured results is increasingly important. First for order processing, where the customer wants to reduce the costs and workload of his vendor inspection department. The supplier therefore becomes

more and more responsible for quality control – and must be able to certify the quality. Second, the legal demands on documentation prescribe verifiable results for safety reasons. Especially important for ship and aircraft transmissions.

PRODUCT LIABILITY. Due to new legislation regarding product liability, an increasing number of companies require carefully documented results, which must also be accessible in the future. This is no problem with the flexible data handling of the EMZ.

THE EMZ INSPECTION CENTERS are fulfilling these demands. The measured results are documented simultaneous to the measurement on the plotter – fully automatic and in four colors.

STATISTICAL PROCESS CONTROL. A consistent level of quality can only be attained with processes which are statistically controlled. The statistical software SAM is designed to support process control and can process all deviation parameters which are determined by the measuring device. Thus, you gain insight into when and where deviations repeatedly occur, which trends are perceptible and which variations arise.



SAM computes the **statistical values** (mean, standard deviation, etc.) according to the DGQ regulations and DIN 55302.

Advice and service – your guarantee for greatest efficiency

Our strength as a small company lies in flexibility and customer orientation. Our partnership with Carl Zeiss enables us to be at your service worldwide.

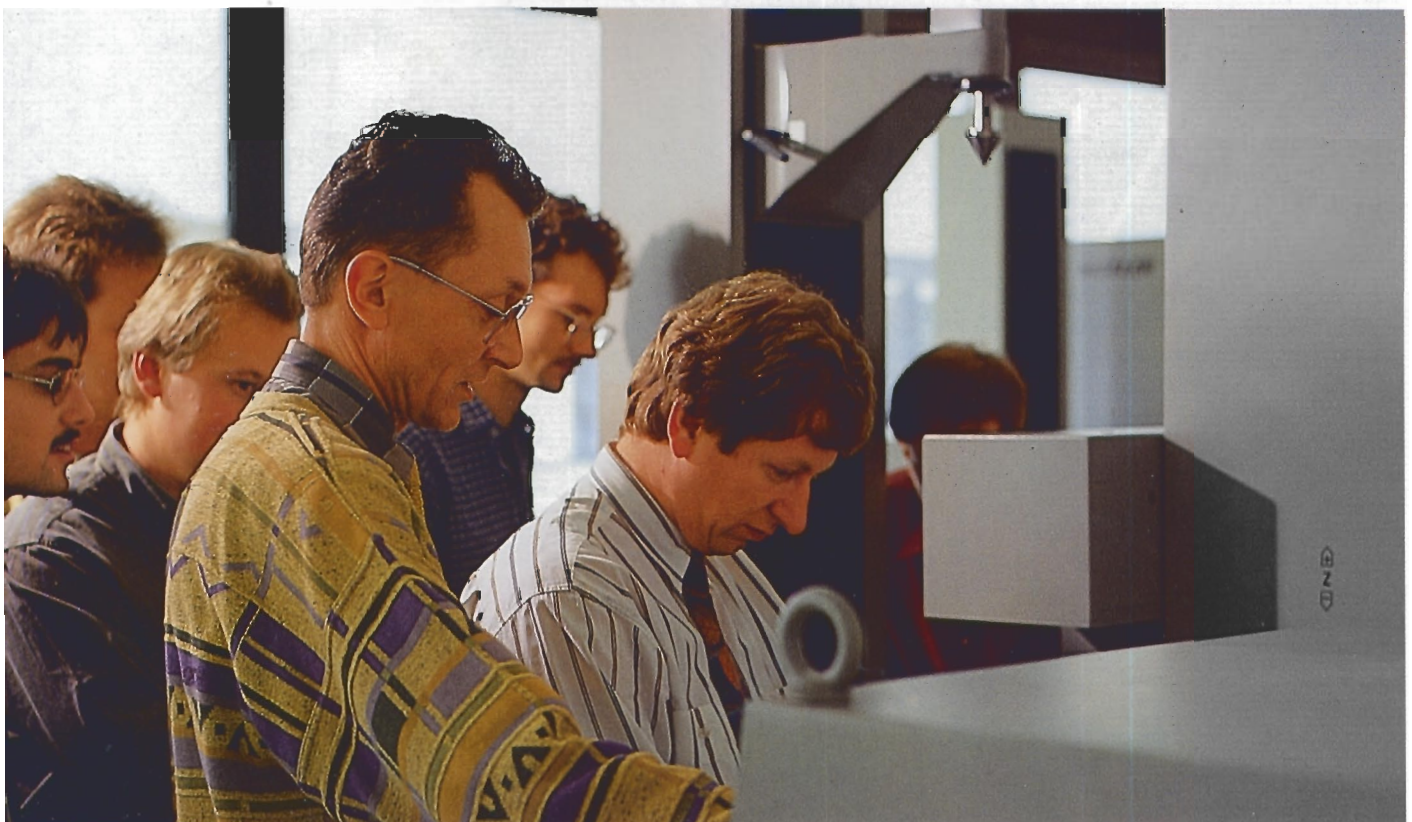
C **OMPREHENSIVE CONSULTATIONS.** Our company offers you the best possible service from any point of view. We thoroughly analyse your measuring requirements prior to sale. We calculate productivity to offer you the right machine for your measuring task. We demonstrate the strengths of our measuring centers with demonstrations at our sales centers or with trial measurements on workpieces. The **INTENSIVE TRAINING** of your personnel after the sale guarantees fast and comprehensive use of your measuring center. Exemplary operating manuals and working instructions help you later during daily work with any measuring task. And when you have special questions - simply call our application technicians. They are happy to satisfy your needs.

EXCELLENT SERVICE. We can offer you a worldwide network of sales and service centers due to our integration in the Carl Zeiss group. Thus, one of our specialists is always in your vicinity, in case a malfunction should at some time occur.



Our **hotline** is always attentive to your questions.

Training of your personnel ensures the **greatest availability** of your measuring center.



Dimensions in mm and inch or specified

		400	630	1000
Workpiece diameter		5-400 / .2-15.7	5-630 / .2-24.8	5-1000 / .2-39.4
Internal gear dia. min. +)		> 20 / .8	> 20 / .8	> 20 / .8
Module range	min./max. D.P.	1-20 / 25.4-1.27	1-20 / 25.4-1.27	1-25 / 25.4-1.0
Helix angle max.	degrees	< 90	< 90	< 90
Number of axes		4	4	4
Travelling distance	X axis	230 / 9.0	230 / 9.0	230 / 9.0
	Y axis	220 / 8.7	340 / 12.6	515 / 21.7
	Z axis	500 (750)/ 19.7 (29.5)	500 (750)/ 19.7 (29.5)	500 (750)/ 19.7 (29.5)
	V axis	-	-	-
Measuring head, number of axes		3	3	3
Distance between centers	max.	1000 / 39	1000 / 39	1400 / 55.1
Table load daN	lbs.	250 / 550	350 (600)/ 770 (1320)	2000 / 4400
Total height		2300 / 90.5	2300 / 90.5	2800 / 110.2
Total width		2800 / 110.2	2800 / 110.2	3050 / 120.0
Total depth		1900 / 74.8	2130 / 83.8	2720 / 107.0
Space requirements	m ²	9	9,8	13



Dimensions in mm and inch or specified

		1300	1300/1600	1600	2000	2000/2600
Workpiece diameter		5-1300 / .2-51.2	5-1600 / .2-63.0	5-1600 / .2-63.0	5-2000 / .2-78.8	5-2600 / .2-102.4
Internal gear dia. min. +)		> 20 / .8	> 20 / .8	> 20 / .8	> 20 / .8	> 20 / .8
Module range	min./max. D.P.	1-25 / 25.4-1.0	1-25 / 25.4-1.0	1-25 / 25.4-1.0	1-32 / 25.4-.8	1-32 / 25.4-.8
Helix angle max.	degrees	< 90	< 90	< 90	< 90	< 90
Number of axes		5	5	5	5	5
Travelling distance	X axis	320 / 12.6	320 / 12.6	320 / 12.6	320 / 12.6	320 / 12.6
	Y axis	680 / 26.8	830 / 32.7	830 / 32.7	1030 / 40.5	1330 / 52.4
	Z axis	750 (1000)/ 29.5 (39.4)	750 (1000)/ 29.5 (39.4)	750 (1000)/ 29.5 (39.4)	1000 / 39.4	1000 / 39.4
	V axis	75 / 3.0	75 / 3.0	75 / 3.0	75 / 3.0	75 / 3.0
Measuring head, number of axes		3	3	3	3	3
Distance between centers	max.	1800 / 70	1800 / 70	1800 / 70	1900 / 74.8	1900 / 74.8
Table load daN	lbs.	5000 / 11000	5000 / 11000	5000 / 11000	10000 / 22000	10000 / 22000
Total height		3550 / 139.8	3550 / 139.8	3550 / 139.8	3600 / 141.7	3600 / 141.7
Total width		3375 / 132.9	3375 / 132.9	3375 / 132.9	3675 / 144.7	3675 / 144.7
Total depth		3300 / 129.9	3300 / 129.9	3400 / 133.8	4200 / 165.3	4200 / 165.3
Space requirements	m ²	16,5	16,5	17,6	22,4	22,4