







## Flexible measuring system for form and roundness in cylinder bores

Measurement and analysis of

- cylinder distortion
- cylinder wear
- temperature influence
- piston ring dimensioning

for engine development and production

-  Roundness
-  Straightness
-  Cylindricity
-  Parallelism
-  Inner diameter
-  Concentricity



V-INCOMETER  
Probe V-200 with electronics

### V-INCOMETER

Quick, reliable, high precision measurement for analytic examination of cylinder piston configuration in engine block development.

### Flexible and mobile

The use of different clamping jaws and measuring tips gives the INCOMETER the flexibility to measure the various cylinder diameters often required in development and laboratory applications. The compact design and easy clamping within the cylinder allow the system to be used directly on site. Furthermore, this system can be used for spot-check examinations in production areas.

### Special features

The V-INCOMETER captures the efficiency and performance of a stationary measuring machine in a compact, rugged design. Self-adjustment within the measuring object eliminates the need for additional axes or time consuming adjustment work while the software eliminates any eccentricity or inclination of the cylinder to the measuring probe.

### Simple operation and handling

The PC-driven system is controlled via the easy to learn Windows Software **INCOWIN**. Measuring routines are pre-defined so that only the appropriate values must be chosen and entered. This eliminates time consuming programming. By changing the appropriate parts (measuring tips and clamping jaws), the probe easily adapts to different diameters.

### Applications

With its over 200 installations worldwide the **V-INCOMETER** is designed for the measurement and analysis of cylinder distortions and is mainly used in engine block development and laboratory areas.

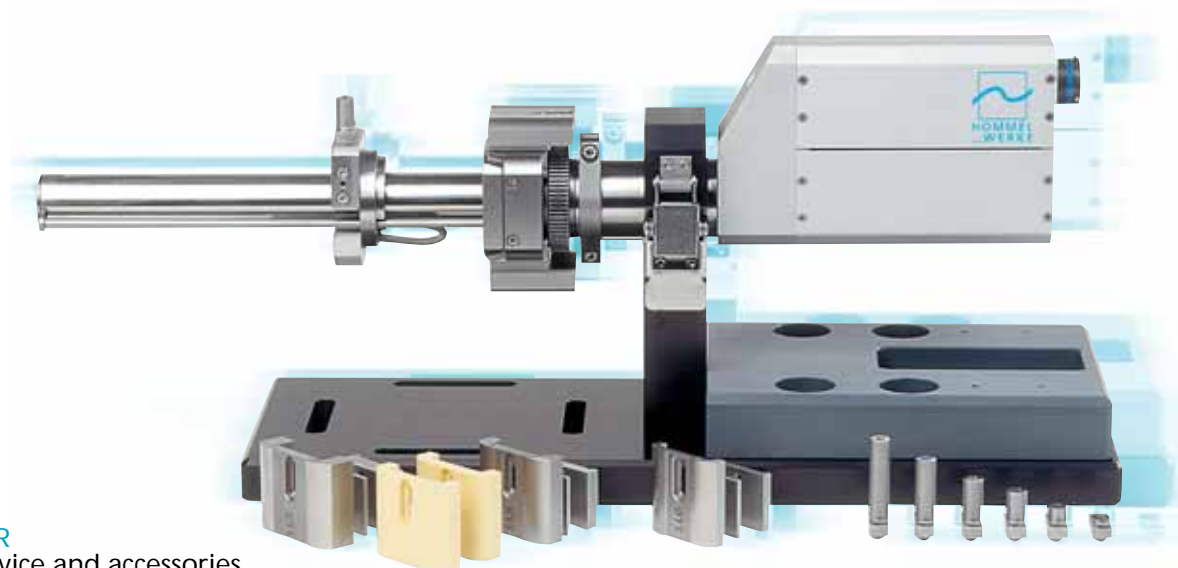
It is especially well-suited for measuring and evaluating the influence of cylinder heads and gaskets on bore distortion in combustion engines. During long-period tests, the wear rate and deformation of the cylinder can be observed. Simple fixturing and quick measurement allow for engine blocks even under high temperature conditions to be measured. This makes it possible to analyze the critical warm-up phase where there are extreme temperature differences between cylinder head and engine block. Theoretical results/models of finite element evaluation can be corrected or confirmed by the measured values.



External plate for fixing the probe



Mobile measuring station



V-INCOMETER  
Mounting device and accessories

## Software options for research and development

### Wear measurement

This module enables the determination of cylinder bore wear. The cylinder bore is measured with high precision, with equally distributed axial scans. Extensive possibilities for the presentation of the measuring results are available.

### Distortion measurement due to temperature

The INCOMETER requires only a few minutes to completely measure a cylinder bore. This speed of operation enables hot engine components (in excess of 100° C) to be measured. The distortion due to temperature can therefore be measured, without relying on simulation methods.

### Mask-off

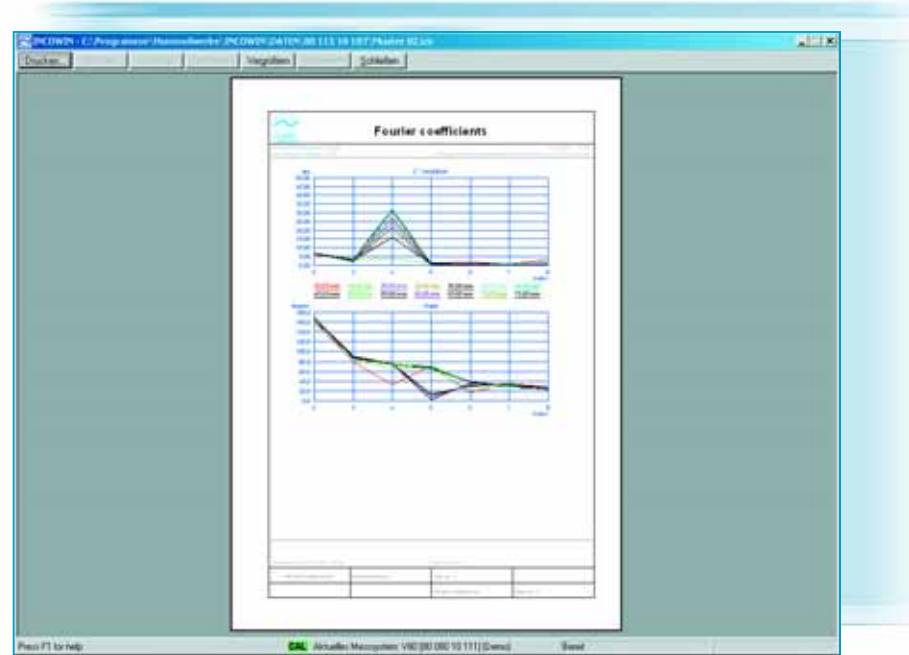
It is important to mask-off certain areas when measuring and evaluating interrupted surfaces, as for example in case of the two-stroke engines.

### Fourier coefficients

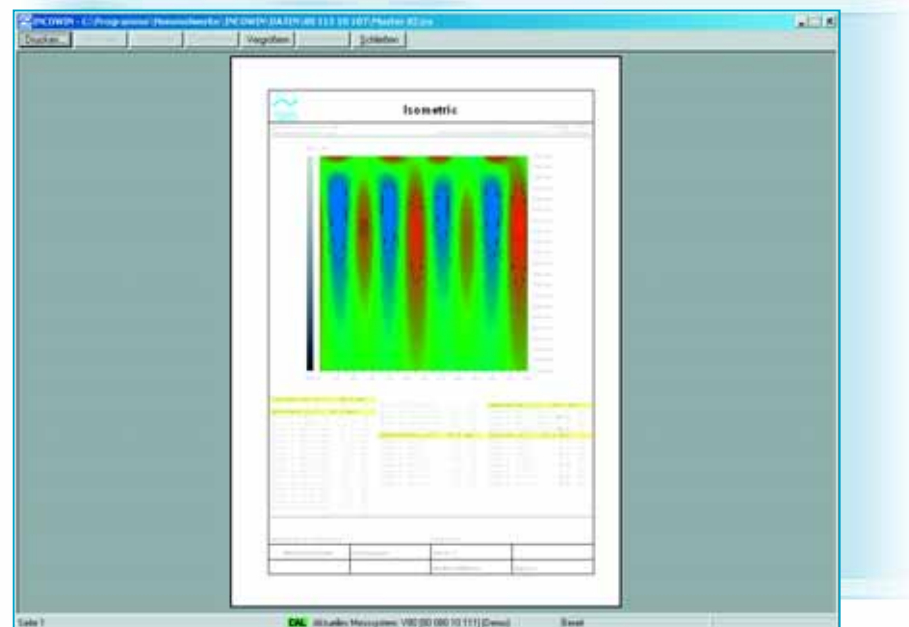
Fourier coefficients in cylinders of internal combustion engines are generally important up to a level of 8. To illustrate the Fourier coefficients better they can be presented graphically.

### Output of data

The INCOWIN software supports you with copying (copy & paste) or exporting (creation of JPG or TXT files for example) your measuring results to other Windows applications.



Graphical presentation of fourier coefficients



Relief map of a distorted cylinder liner

## Software options for manufacturing

### Data transmission to qS-STAT®

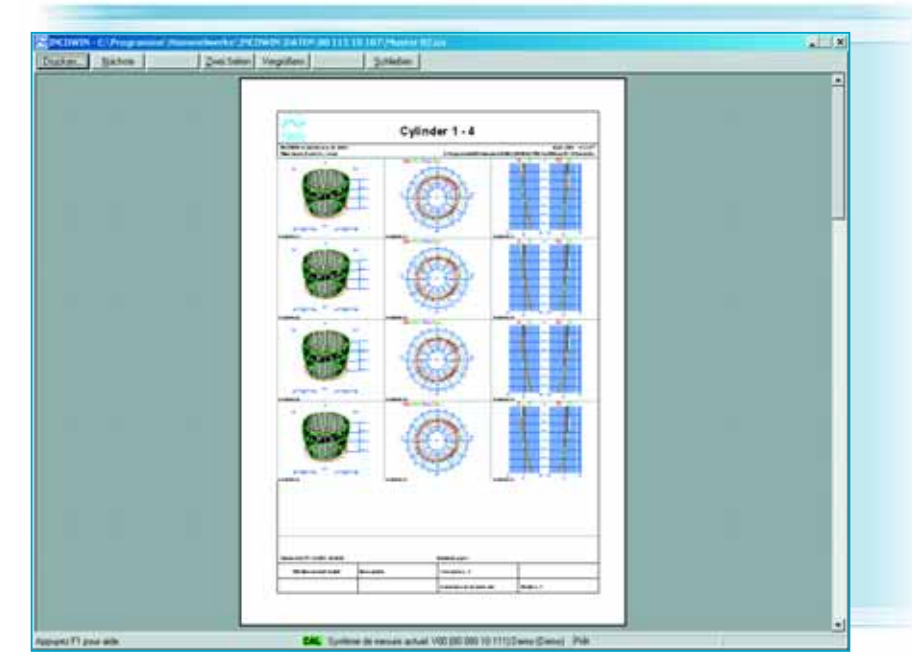
This software package creates files from standard results which can be processed by the SPC package qS-STAT®. The measurement files can be read by other external packages for subsequent statistical evaluation.

### Engine measurement and evaluation

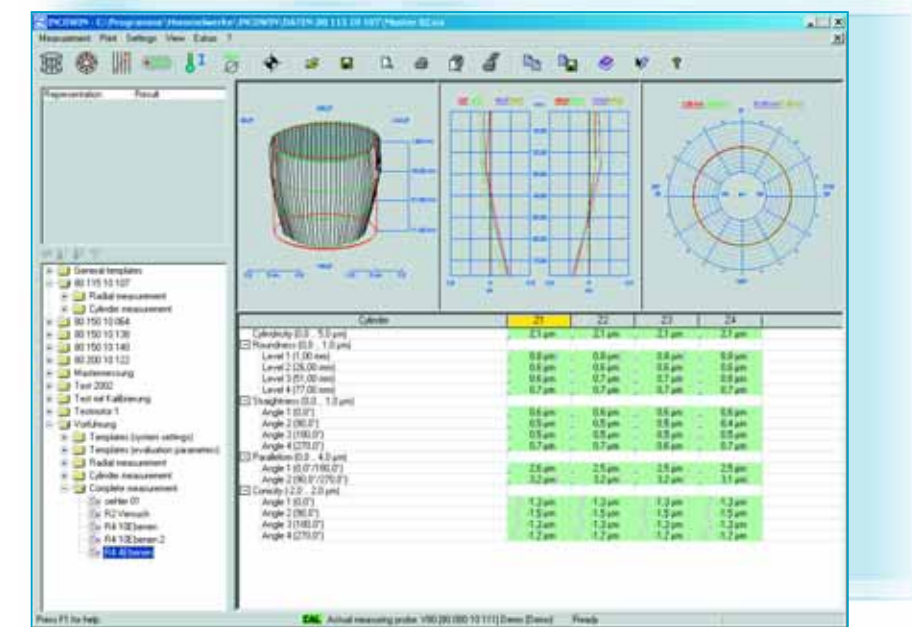
Once all the specification data has been entered into the software, it will enable the measurement of a complete crankcase. The software guides the operator through the measuring procedure. All the measurements for each cylinder are stored in a single file. Evaluation options include the display of the form of each cylinder in a tabular format and also as radial, axial and isometric plots. Multiple plots can be displayed on one page, which can be preset by the operator. Up to 20 graphics are definable on one page.

### Measuring the absolute diameter

This software extension permits the measurement of the absolute diameter of the cylinders in the crankcase. Before each measurement the INCOMETER is calibrated to the nominal dimension of the cylinder diameter. This calibration is performed in a special fixture equipped either with integrated calibration rings or with a fixture plate with built-in calibration rings to be mounted on the cylinder head gasket. A third possibility is to manufacture a calibration cylinder with the nominal dimensions of the cylinder bore.



Complete evaluation of a motor unit



All measuring results at a glance