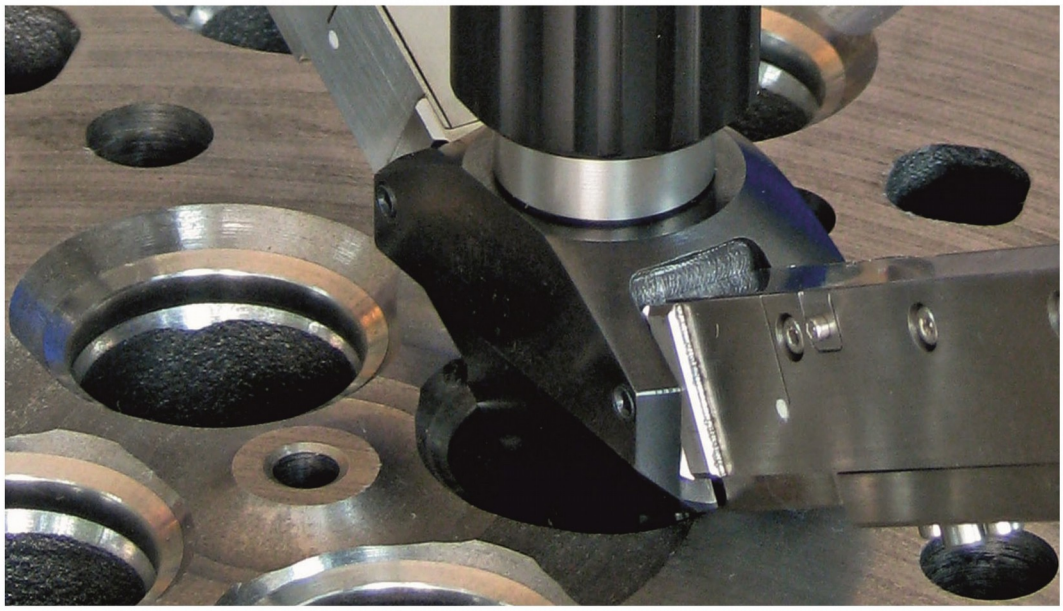
KNÄBEL
präzisionsmesstechnik



MEASURING SYSTEMS FOR CYLINDER HEADS

for high precision measurements

Präzisionsmesstechnik seit mehr als 25 Jahren.
Precision measuring technique since more than 25 years.

KNÄBEL
präzisionsmesstechnik

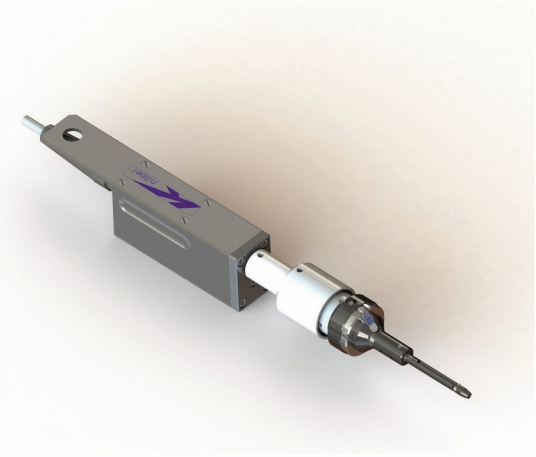
Since more than 25 years we manufacture measuring systems to check cylinder heads in the production area. Customers nearly all over the world use these established devices to measure:

- **Seat contour**
- **Seat form**
- **Seat distance to deck face**
- **Diameter in these parts**

Our measuring devices improve tool life and assist our customers in manufacturing their products under the permanent demand of decreasing tolerances.

Benefits:

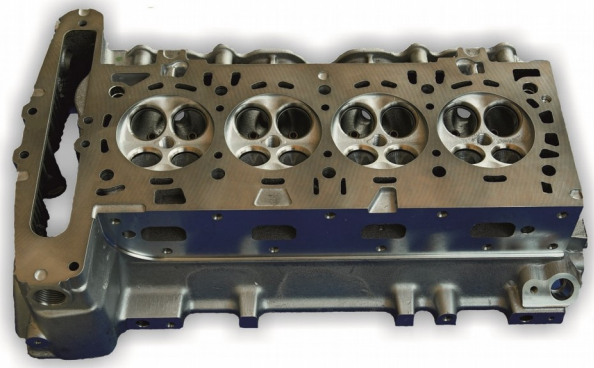
- **All measuring devices from one source**
- **Continuous development**
- **More than 25 years experience**
- **Innovations by communicating with customers**

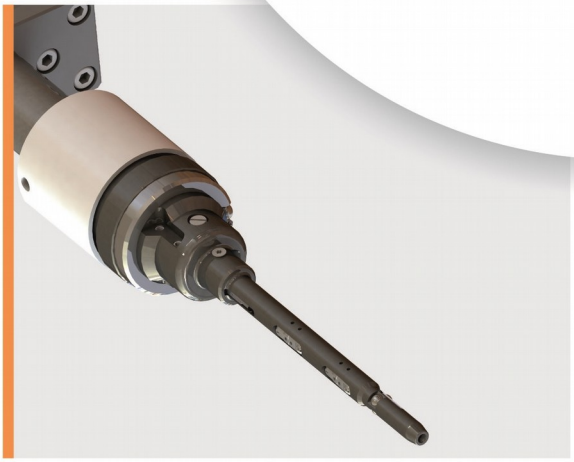


FORM MEASUREMENT WITH VSM

VSM evaluates dynamically round-ness of valve seats and concentricity between valve guide and seat. Due to its unique cardan coupling, the mandrel performs the measurement without operator influence and even the use in align positions is possible. Additionally, a combined version - measuring intake and exhaust seat with one gage - is available.

The **VSM** lays upon the valve seat and rotates 360 degrees. During the motion it scans the valve seat, as well as the upper diameter of the valve guide bore and evaluates roundness and concentricity by a MIN-MAX comparison. Cycle time approximately four seconds.





FORM AND DIAMETER MEASUREMENT WITH VSFM

The **VSFM** is based upon the **VSM** principle.

In addition to the common measurement characteristics the **VSFM** perfoms measure-ments within the valve guide.

During a dynamic measurement at a 360° turn, the **VSFM** is able to scan the diameters at three positions and the straightness at the same time.

UNIVERSAL CONTOUR MEASUREMENT W. SLIDE SCAN

Within only one operation this gage scans the outline of valve seats and reports seat angle, seat width, straightness of the seat and the position of the gage line diameter.

SlideScan is a universal gage and enables the measurement of several seats within a big range of different gage line diameters, like i.e. between 24 mm and 34 mm - other ranges are available on request.

Possible applications: car engines and special engines as well as heavy truck en-gines, gas engines and motorbike engines.

Cycle time is approximately four seconds.

MEASURING SYSTEMS FOR CYLINDER HEADS

COMBINED FORM/CONTOUR MEASUREMENT WITH VSKM

VSKM combines form and contour measure-ment within one gage. It verifies roundness and run out, seat angle, seat width, straight-ness and gage line position / position of gage line diameter.

The gage is equipped with two opposite probes scanning the complete seat contour. One of these probes - likewise both - is used to measure the roundness on the seat. A third probe - located in the gage shaft - measures run out between guide bore and seat.

By its compact design this gage is very immune to interference contours and can easily perform the measurement of these features through adapter plates.

DEPTH MEASUREMENT WITH VTM

VTM measures the distance between the gap line diameter and deck face. These gaps are applicable for all standard gage diameters, never mind if the seats are parallel or tilt.

Likewise they can be equipped with induc-tive probes or dial indicator.

SOFTWARE & COMPUTERHARDWARE

Software features

- Numerical and graphical display of the measurement results
- Multilingualism
- Export into QS-Stat data-file
- Quality control plan administration
- Off-line processing

Computer features

- TFT display with touch screen
  Robust case with IP-protection
- Wide input power supply

LOCATION

Horst Knäbel GmbH | Robert-Bosch-Str. 8 | D-40668 Meerbusch

CONTACT

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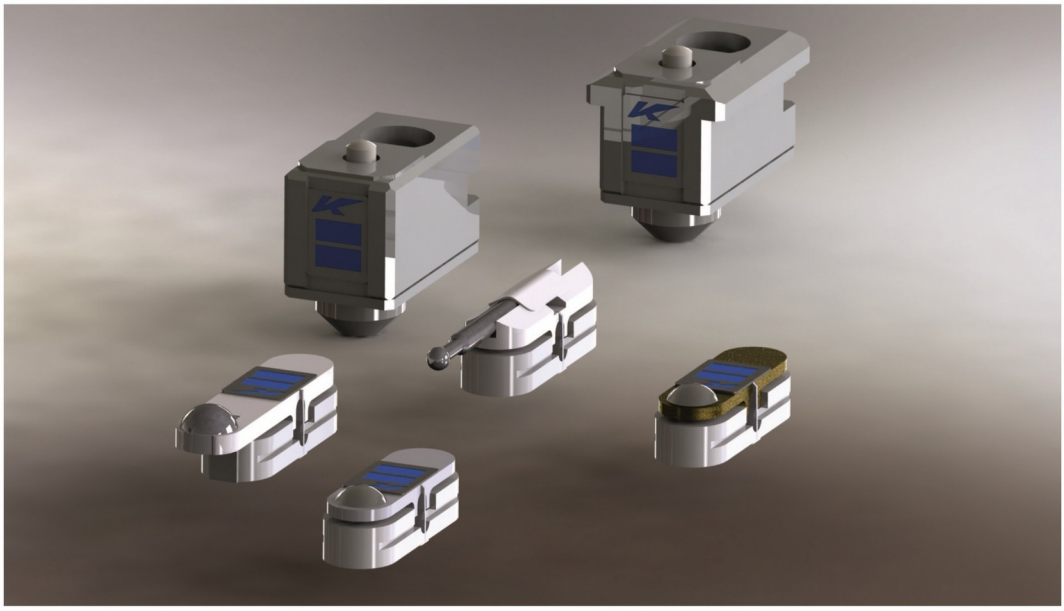
KNÄBEL
präzisionsmesstechnik

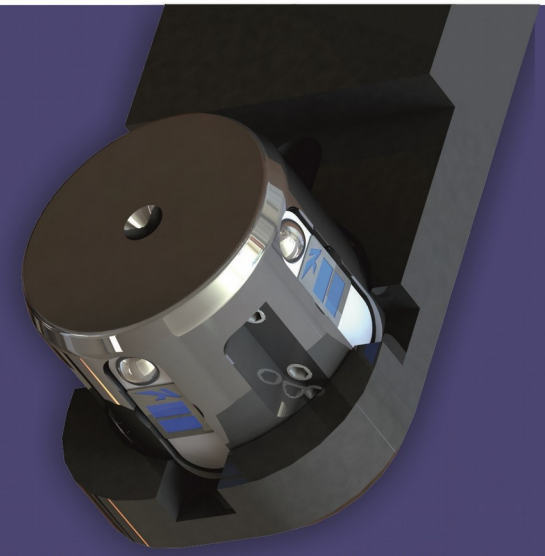


MESSTASTER
für hochgenaueste Anwendungen

PROBES
for high precision operations

Präzisionsmesstechnik seit mehr als 25 Jahren.
Precision measuring technique since more than 25 years.

KNÄBEL
präzisionsmesstechnik



Die Knäbel Messtaster stehen für kleinste Abmessungen bei höchster Präzision.

So wird es dem Anwender ermöglicht, die Messtaster direkt an der zu messenden Stelle zu platzieren.

IET und **KMT** zeichnen sich durch vielfältige Bauformen und große Messbereiche aus, die neuen **IET** 13 KHz Taster durch noch einfachere Anschlussmöglichkeiten.

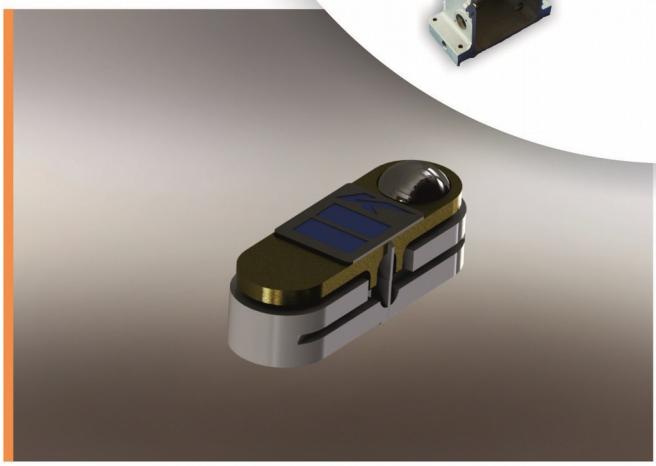
Minimale Baugröße bei maximalem Messbereich!

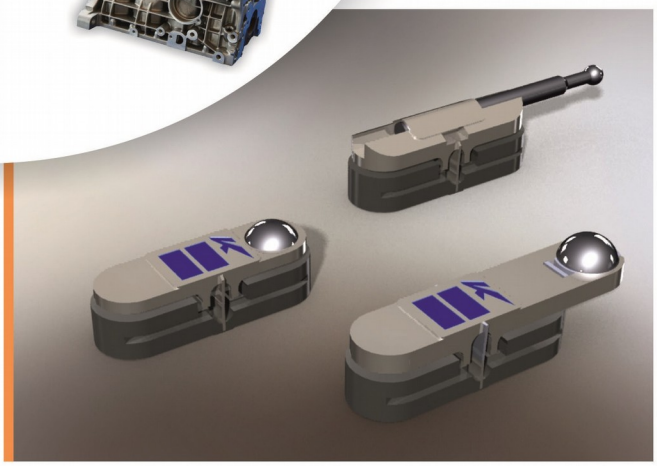
The Knäbel probes achieve highest precision by minimal size.

The benefit for the user is to place the probes very close to the measurement point.

A big range of types is available for **IET** and **KMT** in combination with huge measurement ranges. The new **IET** 13 KHz Tesa compatible probes are characterized by a very simple installation.

Minimum size at maximum range!





IET - TESA© kompatibel

- 13 KHz Speisefrequenz.
- Viele Ausführungen möglich.
- Offene Bauform.
- Messhub +/- 200 µm.
- Vollkommen frei von Reibung und Hysterese.
- Abmessungen 5 x 5 x 15 mm.

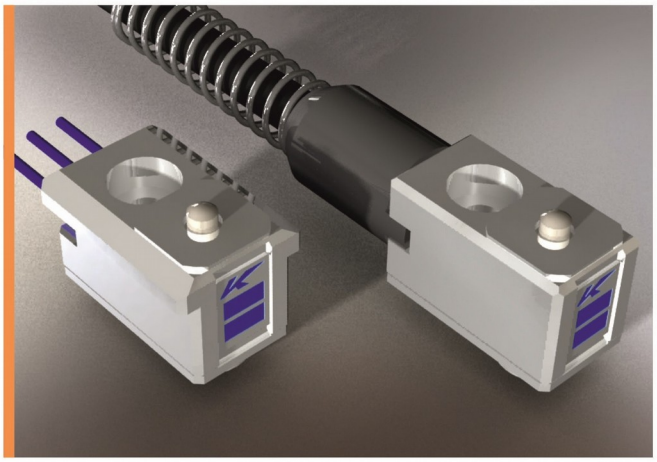
IET

- Viele Ausführungen möglich.
- Offene Bauform.
- Messhübe von +/- 200 µm bis +/- 800 µm.
- Vollkommen frei von Reibung und Hysterese.
- Optional als Tasterblock ohne Justage.
- Abmessungen 5 x 5 x 15 mm.

- 13 KHz frequency.
- Many different types available.
- Open design.
- Measurement range +/- 200 µm.
- Free of friction and hysteresis.
- Size 5 x 5 x 15 mm.

- Many different types available.
- Open design.
- Measurement ranges from +/- 200 µm up to +/- 800 µm.
- Free of friction and hysteresis.
- Likewise available as measurement cell for use without adjustment.
- Size 5 x 5 x 15 mm.

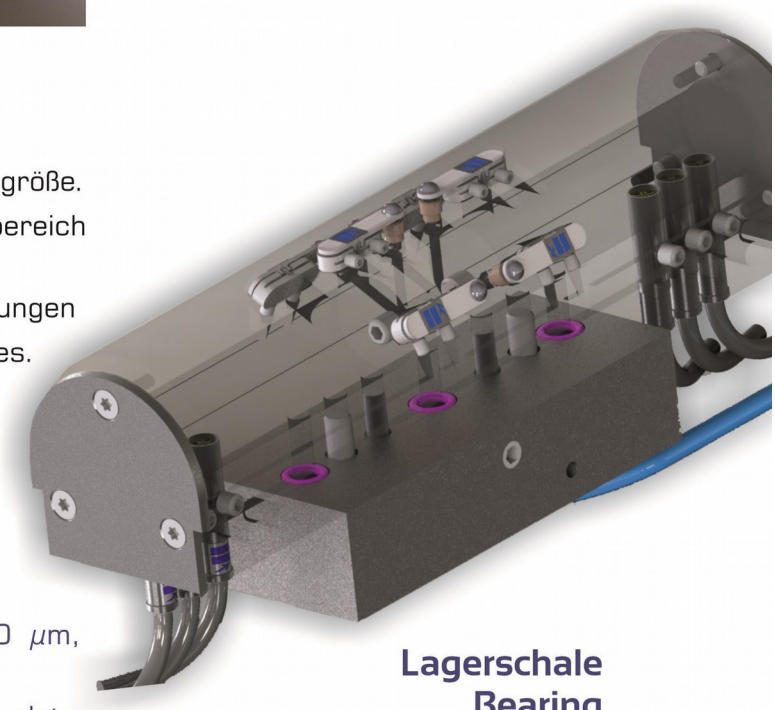
MESSTASTER
PROBES



KMT

- Gekapselte Bauform.
- Maximaler Messbereich bei kleinster Baugröße.
- Messhub bis zu +/- 1000 µm, Messbereich analog +/- 250 µm.
- Besonders geeignet bei Nuten und Lagerungen
- Pneumatischer Antrieb des Tastelementes.
- Tastelement mit hochfester Keramik.
- Luftspülung.
- Abmessungen 8 x 8 x 15 mm.

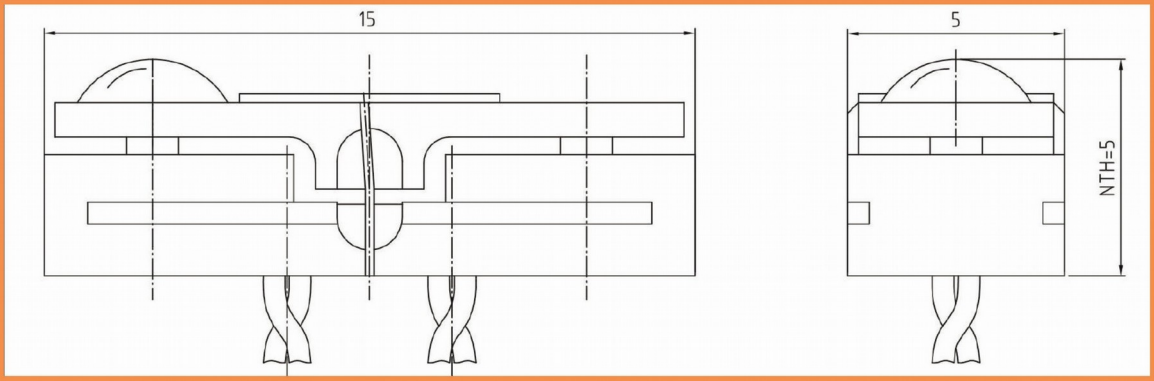
- Compact design.
- Maximum range by smallest size.
- Measurement stroke up to +/- 1000 µm, analog measurement range +/- 250 µm.
- Especially appropriate to measure within slots and bearings.
- Pneumatic drive of probe tip.
- High strength ceramic probe tip.
- Cleaning air.
- Size 8 x 8 x 15 mm.



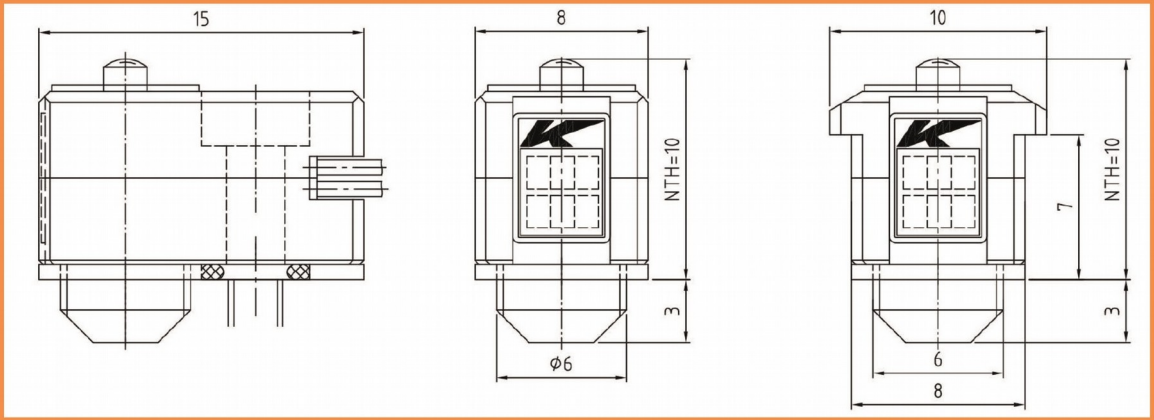
Lagerschale
Bearing

DIMENSIONS AND TECHNICAL SPECIFICATIONS

Typ IET



Typ KMT



Type	IET-T	IET	KMT
Measuring principle	Inductive, half bridge	Inductive, half bridge	Inductive, half bridge
Supply voltage	Tesa comp.	Knäbel IET comp.	Tesa comp.
Probe tip	SIC	SIC	Ceramic
Actuation	Spring	Spring	Pneumatic / spring
Fixing	Crew, at the side	Crew, at the side	One screw
Design	Open	Open	Capsuled
Linearity	1% FS	0,5% FS	1% 200 μm

LOCATION

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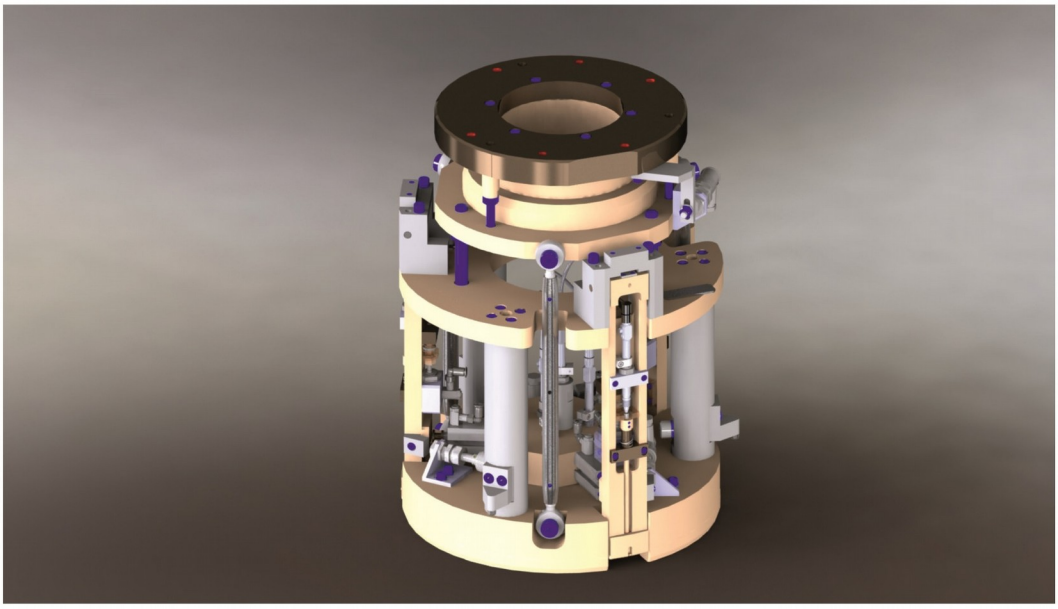
KNÄBEL
präzisionsmesstechnik



VORRICHTUNGEN

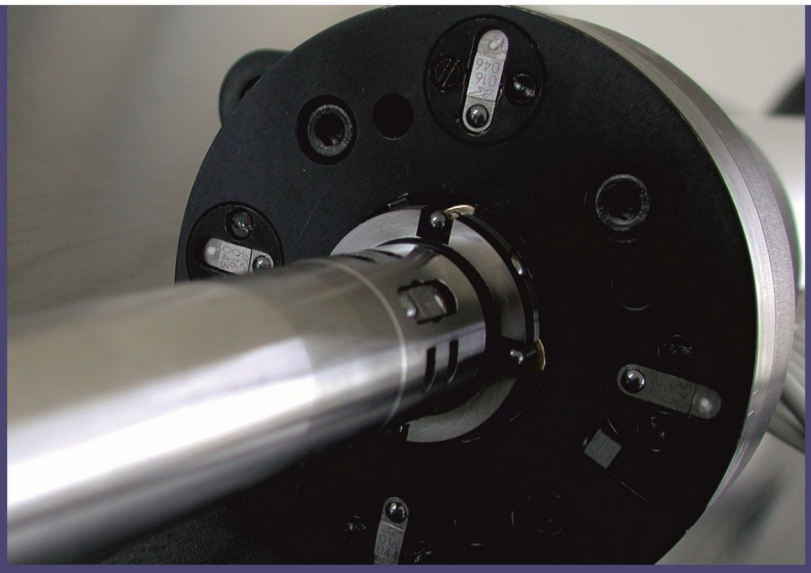
hochgenaueste Messungen in der Fertigung

FIXTURES

high precision measurements on the shop floor

Präzisionsmesstechnik seit mehr als 25 Jahren.
Precision measuring technique since more than 25 years.

KNÄBEL
präzisionsmesstechnik



Vorrichtungen als Sonderlösungen für Ihre Bauteile und Anforderungen.

Vielfach verwendete Baukastenlösungen zum Messen von Nuten, Einstichen, Lamellen, Innendurchmessern, Tiefen und mehr.

Mit Positionsausgleich und Auflaufschutz zum Anbau an Zustelleinheiten und Robotern.

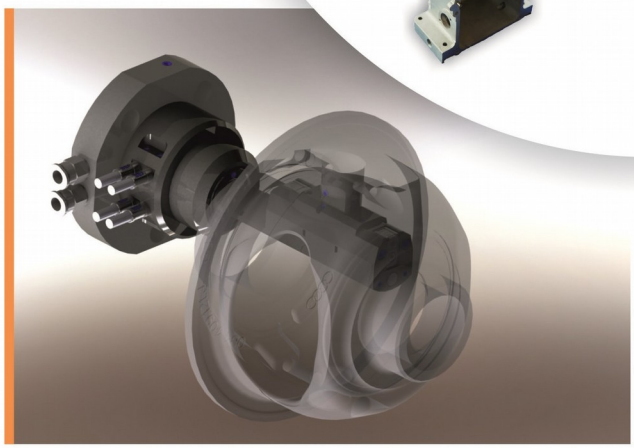
Minimale Baugröße bei höchster Präzision!

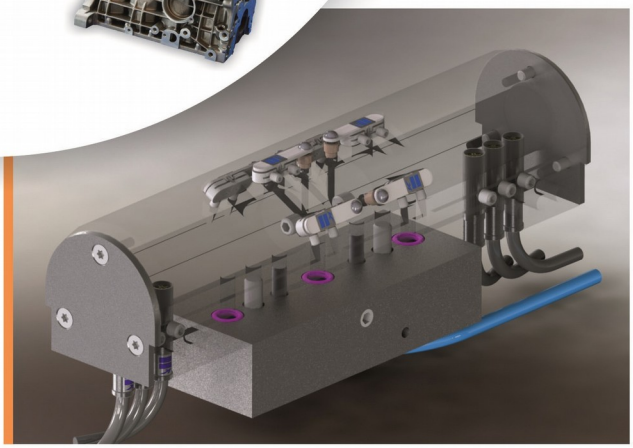
Special solutions for your parts and requirements.

Frequently used modul solutions for measuring of grooves, insertions, inside diameters, depths and more.

Design with positioning compensation and collision protection.

Minimum size at maximum precision!





DIFFERENZIAL
DIFFERENTIAL GEAR

- Adaptierbarer Messkopf für die Differenzial Messung.
- Mit 2 IET und 2 KMT Messtastern.
- Taster pneumatisch zugestellt.
- Messung auf Umschlag 180°.
- Messung an den Flächen und in der Bolzenbohrung.

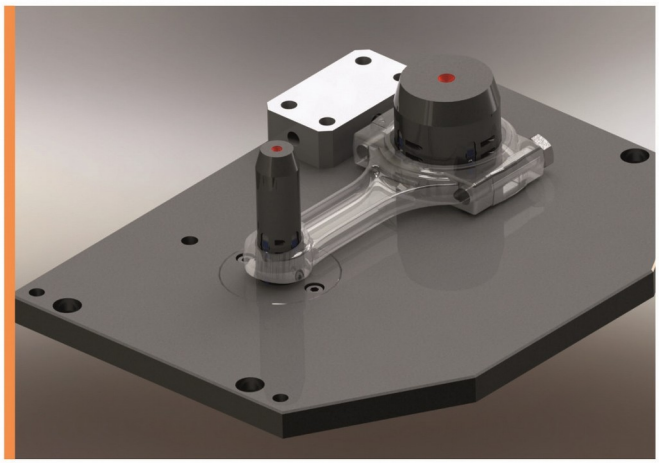
- Adaptable measuring head for differential gear measurement.
- Equipped with 2 IET and 2 KMT probes.
- Pneumatic feed motion.
- Measurement at two positions.
- Measurement on the surface areas and in the pin bore.

LAGERSCHALE
BEARING

- Mit 6 oder mehr Messpunkten.
- Ab 20 mm Durchmesser.
- Pneumatische Messzustellung.
- Wechseladapter zum Aufspannen.
- Taktzeit ca. 0,5 Sek.

- Design with 6 or more measuring points.
- 20 mm diameter and larger.
- Pneumatic measurement drive.
- Exchange adapter for clamping.
- Cycle time approx. 0,5 sec.

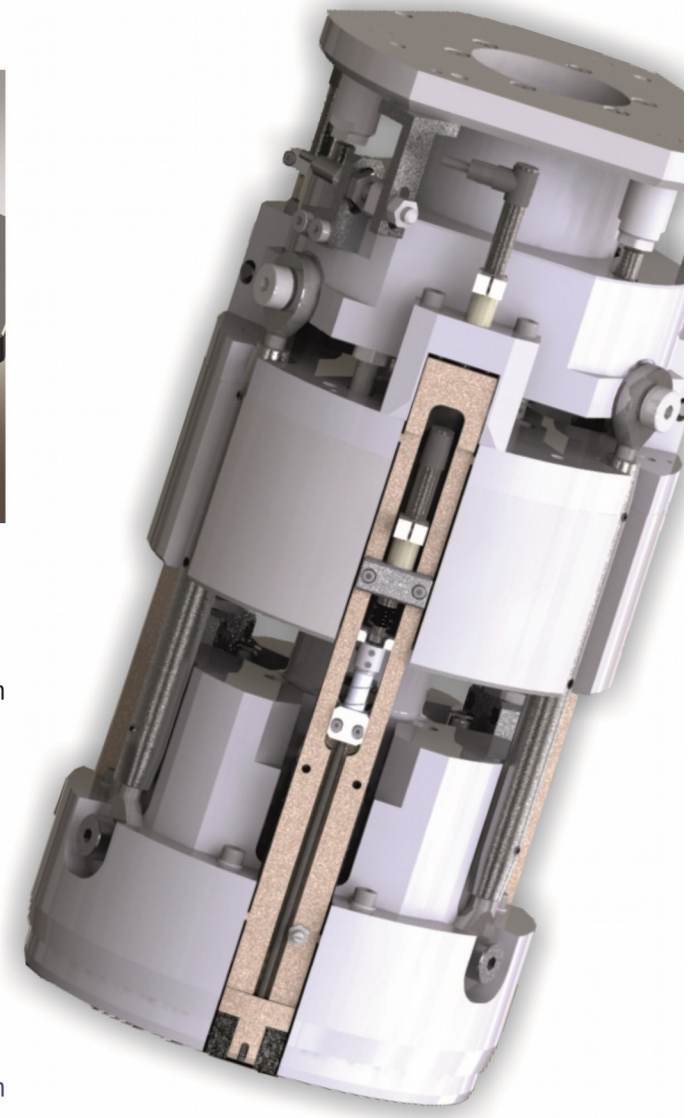
VORRICHTUNGEN
FIXTURES



PLEUEL
CON-ROD

- Messung aller Typen vom Kleinstmotor bis zum LKW.
- Großes und kleines Auge mit je 12 Tastern.
- Messung:
  Durchmesser und Rundheit,
  Planschlag und Dicke,
  Verbiegung und Verdrehung,
  Achsabstand.

- Measurement for all types of engines, from small motor to truck.
- Large and small bore measurement with 12 probes
- Measurement:
  Diameter and roundness,
  axial runout and thickness,
  deflection and torsion,
  distance between axles.

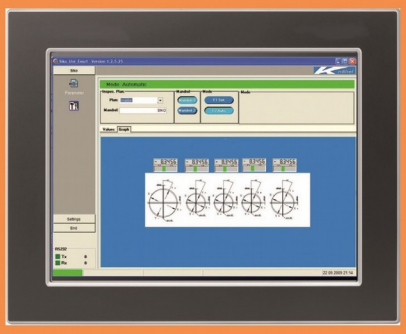


Messvorrichtung Nut/Lamelle
Measuring device gap/plate

SOFTWARE & COMPUTERHARDWARE

Software features

- Numerical and graphical display of the measurement results
- Multilingualism
- Export into QS-Stat data-file
- Quality control plan administration
- Off-line processing



Computer features

- TFT display with touch screen
  Robust case with IP-protection
- Wide input power supply

LOCATION

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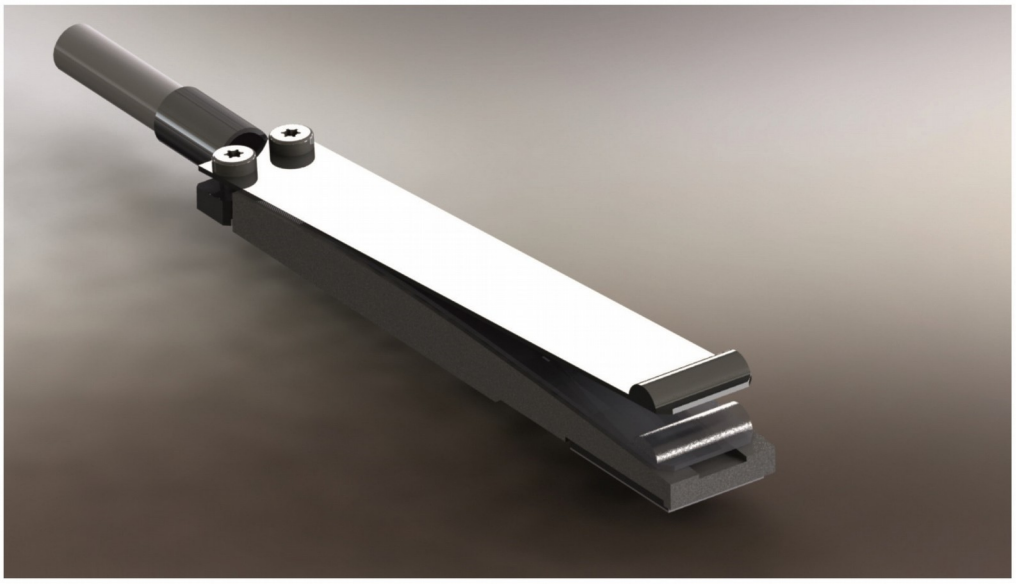
KNÄBEL
präzisionsmesstechnik



KAROSSERIEMESSUNG

hochgenaueste Messungen in der Fertigung

CAR BODY MEASUREMENT

high precision measurements on the shop floor

Präzisionsmesstechnik seit mehr als 25 Jahren.
Precision measuring technique since more than 25 years.

KNÄBEL
präzisionsmesstechnik

Die Karosseriemessung ist ein komplettes System zum Kontrollieren der Eigenschaften: Schachtmaß, Spaltmaß und Bündigkeit der Karosserie.

Im Gegensatz zur konventionellen Messung wird diese Messung nicht durch die sehr kleinen Federkräfte beeinflusst.

Die Auswertung kann mit Handmessgeräten oder stationären Messrechnern erfolgen.

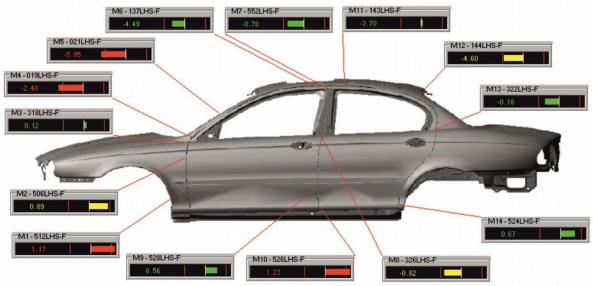
Minimale Baugröße bei höchster Präzision!

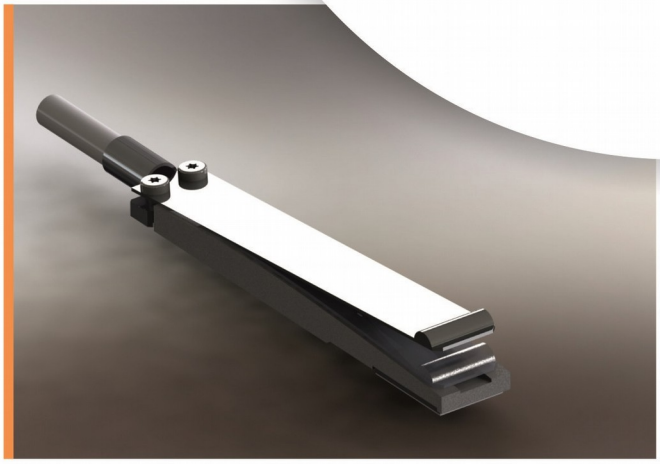
The car body measurement is a complete system to check the characteristics: body cavity, gap and concision of a car body.

It does not influence the measurement through the very small spring tensions, contrary to conventional measurement.

It can be evaluated by handheld measuring devices or stationary measuring computers.

Minimum size at maximum range!

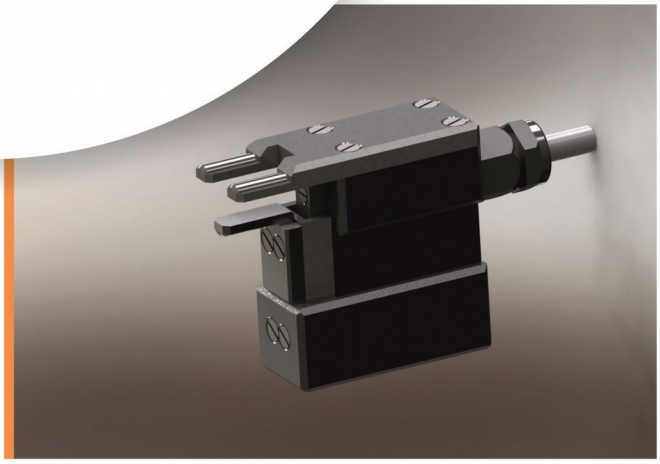




SCHACHT
BODY CAVITY

- Zur Messung der verdeckten Hohlräume in der Karosserie an Türen, Front und Heckklappen.
- Durch den Magnetfuß wird der Taster sicher positioniert bevor die Tür/Klappe geschlossen wird.
- Messbereich 9 mm.
- Sonderform mit Klemmung auf der Falz als Heckklappentaster.

- For measuring the hidden cavity of a car bodies door, front hood and hatchback.
- The magnetic foot positions the probe safely before the door/hatch is closed.
- Measuring range 9 mm.
- Special form with clamping on the rabbet as hatchback probe.

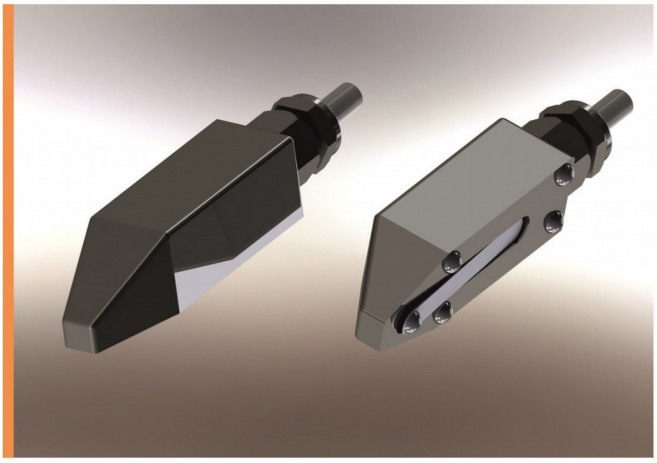


SPALT
GAP

- Zur Messung werden die gefederten Gehäusehälften zusammengedrückt und eingelegt.
- Die Messung erfolgt mit Federkraft.
- Messbereich 2 bis 4 mm.
- Auf Wunsch sind verschiedene Formen der Messanlagen möglich, auch als Formteile.

- For measuring press and insert the spring-loaded two halves.
- The Measurement is carried out by spring tension.
- Measuring range from 2 to 4 mm.
- By request different designs of the probe and even moulded parts are possible.

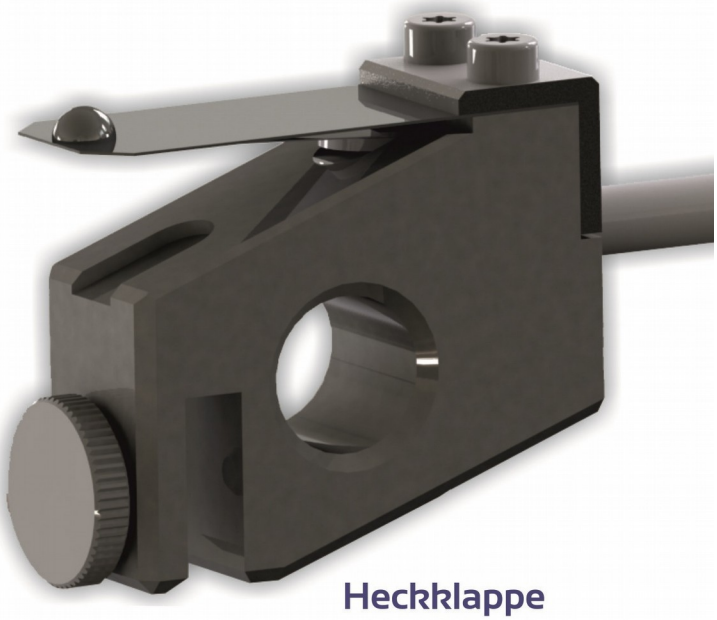
KAROSSERIEMESSUNG
CAR BODY MEASUREMENT



BÜNDIGKEIT
CONCISION

- Messung mit eingelassenem Knäbel Messelement.
- Liegt sicher mit einer 3-Punkt-Auflage auf der Karosserie.
- Auf Wunsch auch mit Formauflage.
- Messbereich +/- 2 mm bis +/-4 mm.
- Ergonomische Gestaltung zum sicheren Greifen.

- Measurement with embedded Knäbel measuring element.
- Rests safely upon the car body on its three-point-support.
- By request also available with mold support.
- Measuring range +/-2 mm to +/-4 mm.
- Ergonomic design for a safe grip.

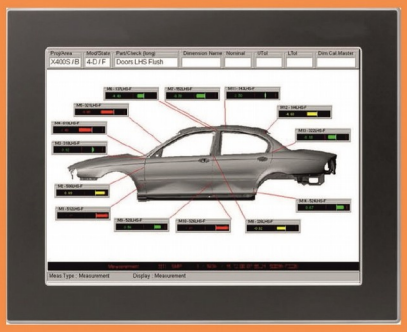


Heckklappe
Hatchback

SOFTWARE & COMPUTERHARDWARE

Software features

- Numerical and graphical display of the measurement results
- Multilingualism
- Export into QS-Stat data-file
- Quality control plan administration
- Off-line processing



Computer features

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  Robust case with IP-protection
- Wide input power supply

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Horst Knäbel GmbH

IET

Baureihe 0
Series 0

IET - ein Begriff für
induktive Einbaumeßtaster

- der Größenordnung von **5x5x15 mm**
- mit Meßbereichen von +/- **0,2 und** +/- **0,4 mm**
- und einer Vielzahl spezieller Varianten zur **direkten Messung** von Bohrungen, Nuten und den Abständen schmaler Flächen zu ihren Bezugsebenen.

IET - a synonym for inductive
built-in transducers

- sized **5 x 5 x 15 mm**
- with measuring ranges of +/- **0.2 and** +/- **0.4 mm**
- and a great number of special variants for **direct measurement** of bores, grooves, and of the distances between narrow surfaces and their reference planes.

Horst Knäbel GmbH

Es gibt zahlreiche Meßaufgaben - insbesondere bei der Kontrolle von Bohrungen, Nuten und den Abständen sehr schmaler Flächen zu ihren Bezugsebenen - die bisher nur indirekt unter Verwendung aufwendiger Hebelsysteme oder mittels pneumatischer Meßverfahren gelöst werden konnten, da alle bekannten elektronischen Längenmeßtaster der Meßstelle nicht direkt zugeordnet werden konnten.

Der IET-Längenmeßtaster ist ein sehr kleinbauender induktiver Einbaumeßtaster, der direkt in der Meßebene angeordnet und dazu von einer 5 mm breiten Nut im Meßgeräteträger aufgenommen und mittels zweier Gewindestifte geklemmt werden kann.

Die IET-Längenmeßtaster der Baureihe 0 mit ihren zahlreichen Varianten bieten viele spezielle Lösungsmöglichkeiten.

Aufbauend auf einem mit Spulensystem ausgestatteten Grundkörper und einer federgestützten Wippe, die in ihrer Gestaltung und mit ihrem Tastelement auf die spezielle Meßaufgabe hin ausgelegt werden kann, steht dem Anwender ein sehr vielseitiges Meßtasterprogramm zur Verfügung. Die dafür angebotenen Tastelement-Materialien reichen von Hartmetall, Rubin, Siliciumnitrid bis hin zu Siliciumcarbid.

Der IET-Längenmeßtaster der Baureihe 0 ist völlig frei von mechanischer Reibung und Hysterese. Er ist damit und insbesondere wegen seiner geringen beweglichen Masse bestens zur Lösung hochdynamischer Meßaufgaben geeignet.

Schutzrechte angemeldet

Today many measuring tasks are set - especially when checking bores, grooves, and the distances between very narrow surfaces and their referance planes - where so far merely indirect methods were feasible which necessitated complicated lever systems or pneumatic procedures, since all known electronic length transducers could not be positioned directly at the measuring point.

The IET transducer is an inductive built-in transducer of ultra compact size which can directly be positioned in the measuring plane. The IET is for this purpose sunk into a groove (width 5 mm) of a mandrel and clamped by two thread pins.

The IET transducers of the series 0 with their great number of variants offer a lot of special solutions.

The transducer is composed of a basic body equipped with a coil system and a spring-loaded rocker carrying the sensing element. The design of the rocker may be tuned to the user's particular measuring task and that way a great variety of measuring programmes is placed at his disposal. The sensing elements offered for this purpose range from hard metal over ruby and silicium nitride up to silicium carbide.

The IET transducer of the series 0 is absolutely free from mechanical friction and hysteresis. Hence it is most suitable, in particular because of the insignificant moving mass, for the solution of highly dynamic measuring tasks.

Patent pending

Technische Daten / Technical data

Meßprinzip	**Measuring principle**
Halbbrücke, Differentialdrossel	half bridge, differential throttle
Bauweise	**Design**
offen, Spulensystem vergossen	open, coil system covered
Speisespannung	**Supply voltage**
1,5 Volt eff. bei 50 kHz TF	1.5 Volt eff. at 50 kHz CF
Empfindlichkeit	**Sensitivity**
400 mV / V / mm bei 10 K Lastwiderstand	400 mV / V / mm at 10 K load resistor
Meßbereich	**Measuring range**
Typenreihe 01, 03 und 04 +/- 0,2 mm/ Typenreihe 02, 05 und 06 +/- 0,4 mm	type series 01, 03 and 04 +/- 0.2 mm/ type series 02, 05 and 06 +/- 0.4 mm
Wiederholgenauigkeit	**Repeatability**
Typenreihe 01, 03 und 04 ≦ 0,2 µm/ Typenreihe 02, 05 und 06 ≦ 0,3 µm	type series 01, 03 and 04 ≦ 0.2 µm/ type series 02, 05 and 06 ≦ 0.3 µm
Linearitätsabweichung	**Linear deviation**
Typenreihe 01, 03 und 04 innerhalb von +/- 125 µm ≦ +/- 0,3 µm, innerhalb von +/- 200 µm ≦ +/- 1,0 µm	type series 01, 03 and 04 within the range of +/- 125 µm ≦ +/- 0.3 µm, within the range of +/- 200 µm ≦ +/- 1.0 µm
Typenreihe 02, 05 und 06 innerhalb von +/- 250 µm ≦ +/- 0,5 µm, innerhalb von +/- 400 µm ≦ +/- 2,0 µm	type series 02, 05 and 06 within the range of +/- 250 µm ≦ +/- 0.5 µm, within the range of +/- 400 µm ≦ +/- 2.0 µm
Antastkraft bei Nulldurchgang	**Touching force when passing through zero point**
0,7 N - Standard, 0,2 N - Option, 1,5 N - Option	0.7 N - standard, 0.2 N - optional, 1.5 N - optional
Gewicht der bewegl. Masse - Typ 01 -	**Weight of the moving mass - type 01 -**
0,54 g	0.54 g
Massenträgheit - Typ 01 -	**Mass inertia - type 01 -**
$1{,}03 \times 10^{-6}$ kpmsec^2	1.03×10^{-6} kpmsec^2
Betriebstemperaturbereich	**Range of operating temperature**
- 10 bis + 55 °C	- 10 to + 55 °C
Temperaturkoeffizient	**Temperature coefficient**
= - 0,015% / °K	= - 0.015% / °K
Standardlängen	**Standard lengths**
Länge des Tasterkabels L_1 = 300 mm, Länge der Kupplungshülse L_2 = 27 mm,	length of transducer cable L_1 = 300 mm, length of coupler sleeve L_2 = 27 mm,

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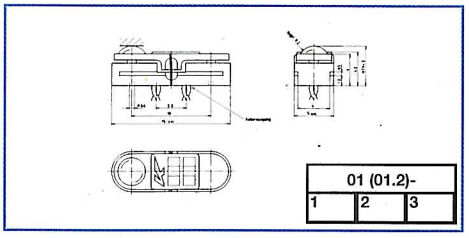
TYPEN-ÜBERSICHT

IET

SURVEY OF TYPES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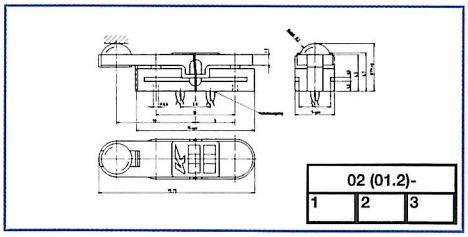
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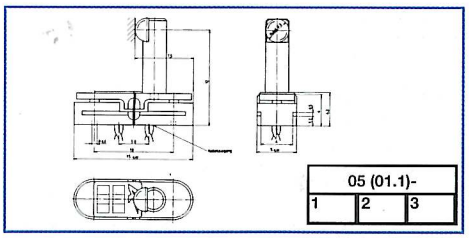
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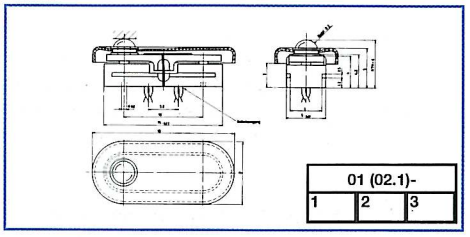
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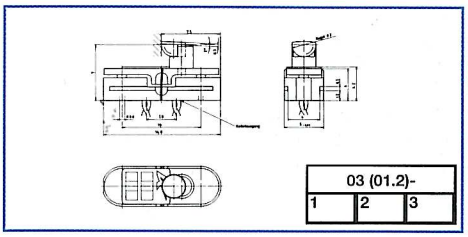
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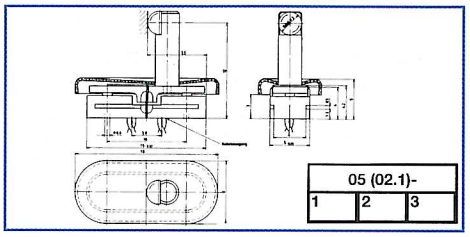
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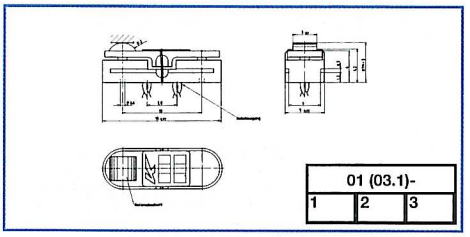
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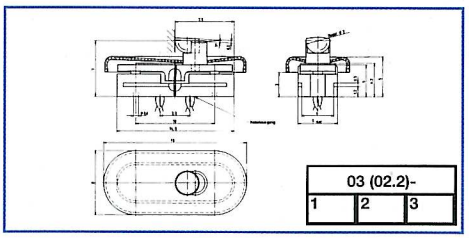
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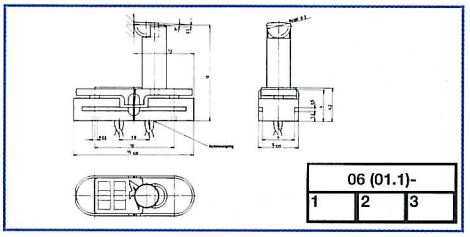
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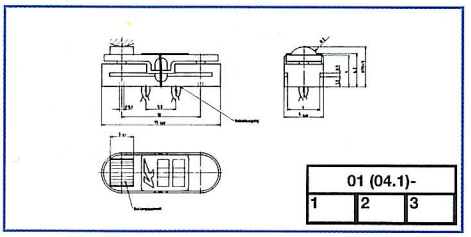
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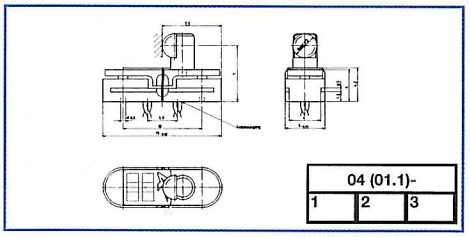
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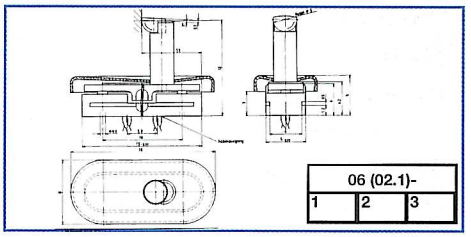
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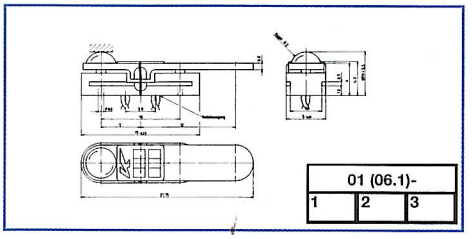
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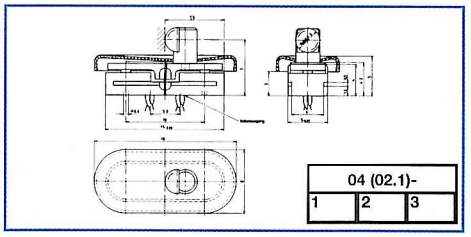
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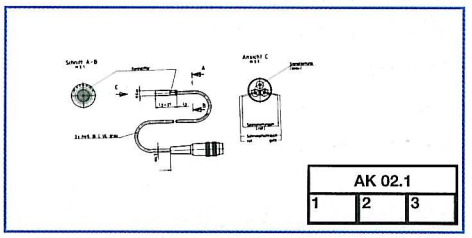
AK 02.1
1 2 3

Bitte kreuzen Sie auf den Zeichnungen bei Interesse für
die Tasterzeichnung die 1
die Einbauzeichnung die 2
die Anwendungsbeispiele die 3 an.

If you are interested in:
the drawing of the transducer please mark N° 1
the drawing for incorporation please mark N° 2
examples of application please mark N° 3
(N°s to be found on the above drawings.)

Fax-Anfrage an: 0 21 32 / 1 08 48
Fax Inquiry to: (your dialling code for Germany) /21 32/1 08 48

Bitte senden Sie uns die in den Zeichnungen und nachfolgend angekreuzten Unterlagen:
Please send us those documents marked in the above drawings and in the following:

- ❒ weitere Informationen / further pieces of information
- ❒ eine Preisliste / a price-list
- ❒ einen Typenschlüssel / a code of types

Firma/company: _____

zuständig/responsible: _____

Straße/street: _____

PLZ/Ort/place/country: _____

Telefon/telephone: _____

Telefax/telefax: _____

Horst Knäbel GmbH

Ausführungsbeispiele: mit IET-Längenmeßtastern bestückte Meßdorne

Examples of Realization: Measuring Mandrels Equipped with IET Built-in Transducers

1 **Flanschmeßdorn**
mit stufenlos verstellbarem Abstand der Meßebene für die Kontrolle von Kolbenbohrungen
Flange measuring gage
with infinitely variable distance of the measuring planes to check piston bores

2 **Standard-Handmeßdorn**
Standard manual measuring mandrel

3 **Handmeßdorne**
zur Überprüfung von Zahnradpumpengehäusen
Manual measuring mandrels
to check gear-pump housings

4 **Kontrollmeßdorne - 12 mm Ø -**
zur Überprüfung von Verriegelungskäfigen
Control measuring mandrals - 12 mm Ø -
to check locking cages

5 **Kegelmeßdorn**
zur Vermessung der Kegelbohrung in einem Zahnrad
Taper measuring gage
to measure the taper bore in a toothed wheel

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NEW!

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Präzisionsmesstechnik

IP PROBE

Designed for Tool Builders, to be used in working machines and other tough environments with exposure to fluids and substances.

The IP Probe features level IP65 Protection against dust and fluids achieved through a durable metal locking system with an upstream soil protector.

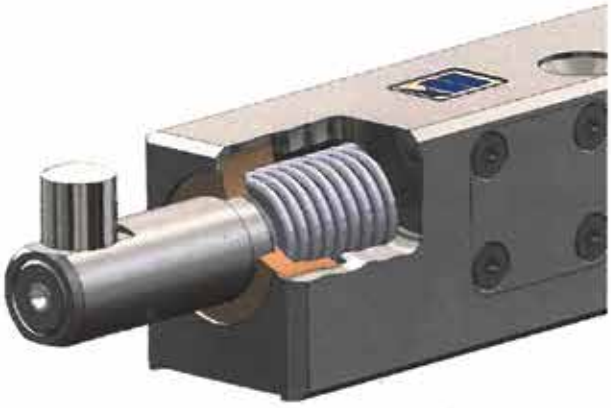
This probe is compatible with any electronics and has an easy, quick, exchangeable tip.

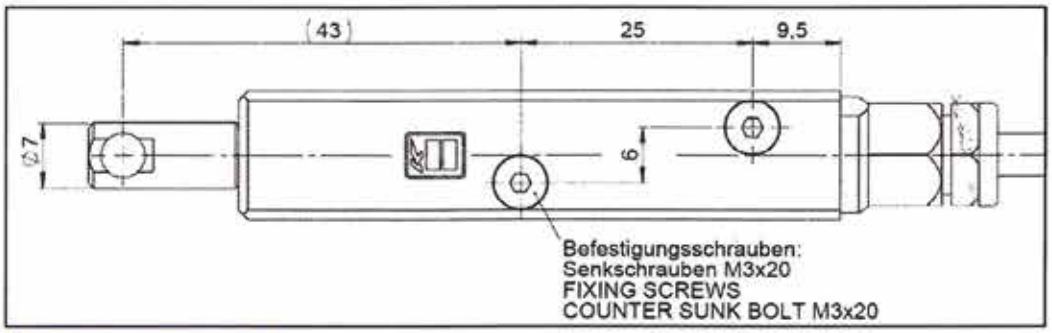
Entwickelt für den Einsatz in Bearbeitungsmaschinen und anderen rauem Umfeld.

Schutzklasse IP 65 zum Schutz vor Schmutz und Flüssigkeiten, erreicht durch dauerfestes metallisches Formelement und vorgelagerter Schmutzabweisung.

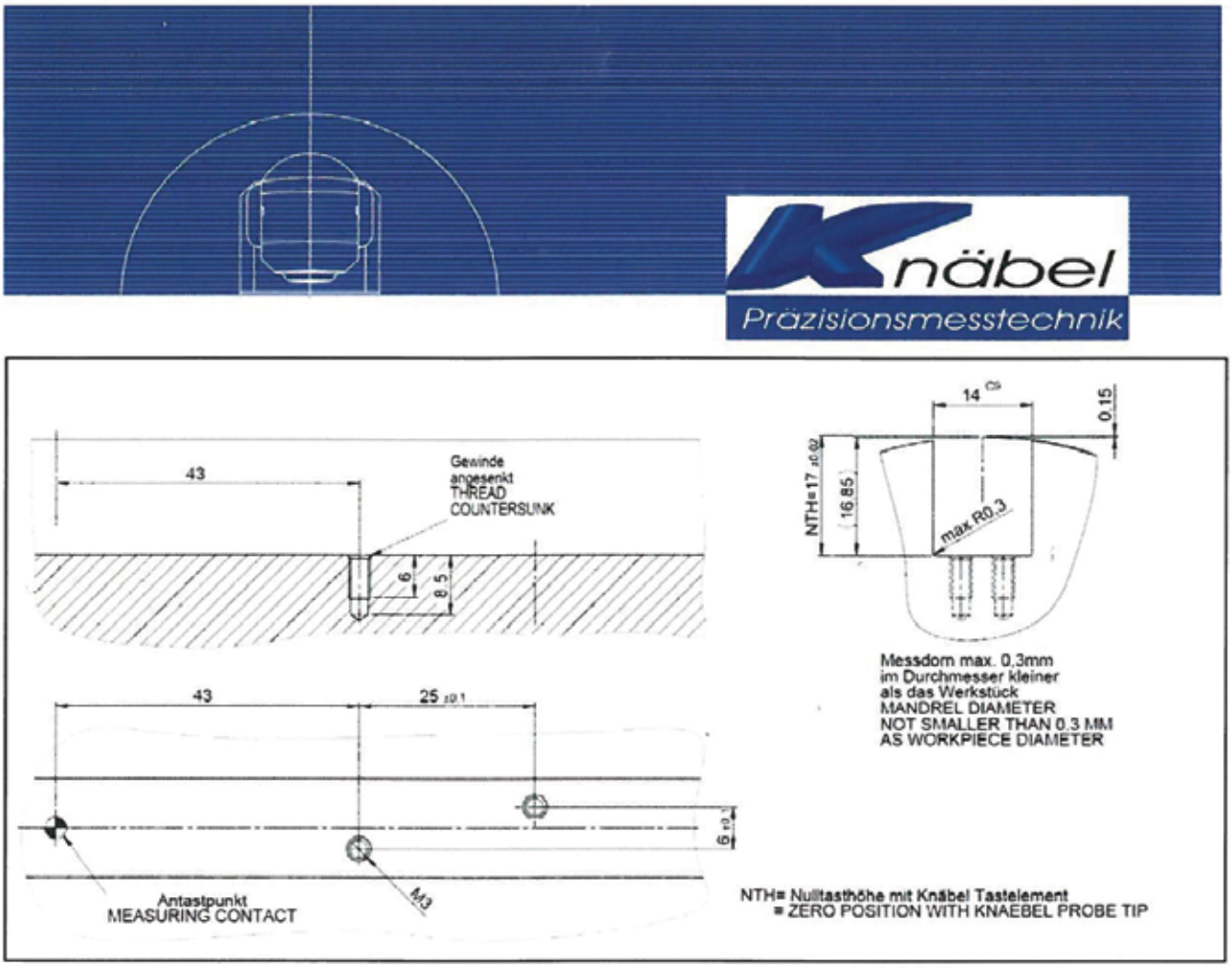
Kompatibel zu allen bekannten Elektroniken.

Austauschbares Tastelement.





IP PROBE



Mechanical Specifications

Probe Name / Bezeichnung	**IP PROBE**
Measuring Range / Messbereich	± 200 [µm]
Linearity Error / Linearitätsabweichung	<= 0.5%
Repeatibility / Wiederholbarkeit	<= 0.1 [µm]
Antastkraft / Probe Force bei NTH	1.75 [N]
Temperature Range / Temperaturbereich	-10°C / +65°C
Cable Length / Kabellänge	Standard 2 [m]
Protection Level / Schutzklasse	IP 65

Half-Bridge (HB) electrical specifications compatible with amplifiers of TESA

Probe Name / Bezeichnung	**IP PROBE**
Calibration frequency] / Speisefrequenz	13 [kHz]
Calibrated at / Eingestellt bei	3V RMS (Load 2kOHM)
Current / Stromaufnahme	1.8 [mA RMS]
Sensitivity /Empfindlichkeit [mV/V/mm]	147.5
Cable Outlet / Kabelausgang	axial
Order Code / Bestellnummer	**IPP-0200-001**

Accessoires

Probe Tip R=2mm / Tastelement R=2mm	**IPP-E0001**
Clamping Device for Tip / Klemmstück für Tastelement	**IPP-E0002**
Schmutzabweiser / Strain Protector	**IPP-E0003**

Euro-Tech Corporation is the exclusive North American distributor of Knaebel probes.
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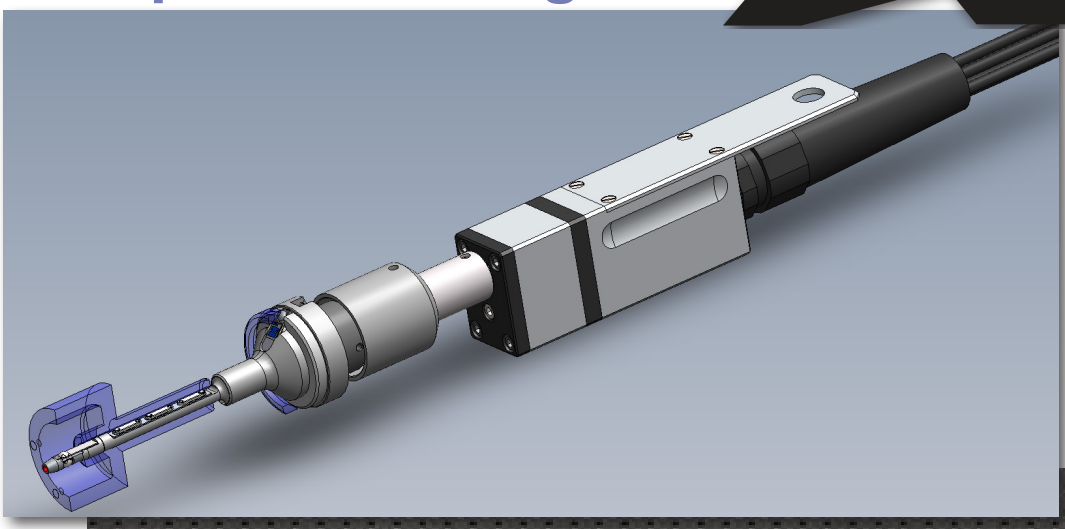
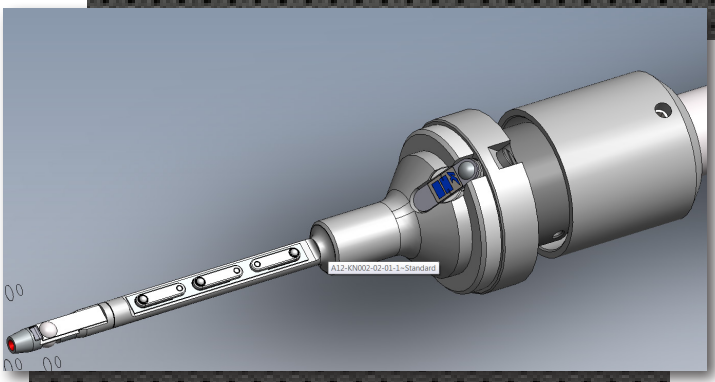
Multiple VSM Gauge



How it works: The mandrel rests on the valve seat and is guided below the valve guide by a separate clamping piece.The guide of the mandrel is equipped with three inductive transducers.In this position the mandrel rotates more than 360° and verifies the features: seat roundness, run out, guide diameter and guide cylinder form.

Features:

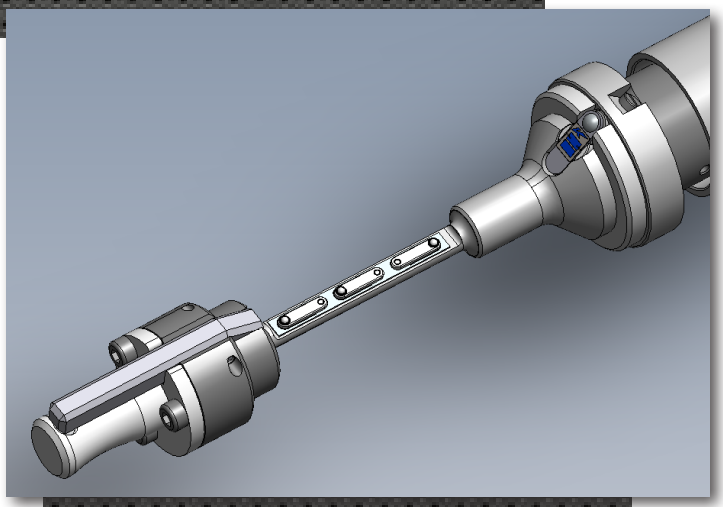
- Seat Roundness
- Run Out Valve Guide to Seat
- Valve Guide Diameter
- Valve Guide Cylinder Form



Three transducer in the guide of the mandrel.

features:

- diameter
- center point
- center axis



The clamping piece is fastening to the OD of the guide.Fixing is achieved by a lever with spring (no tools).

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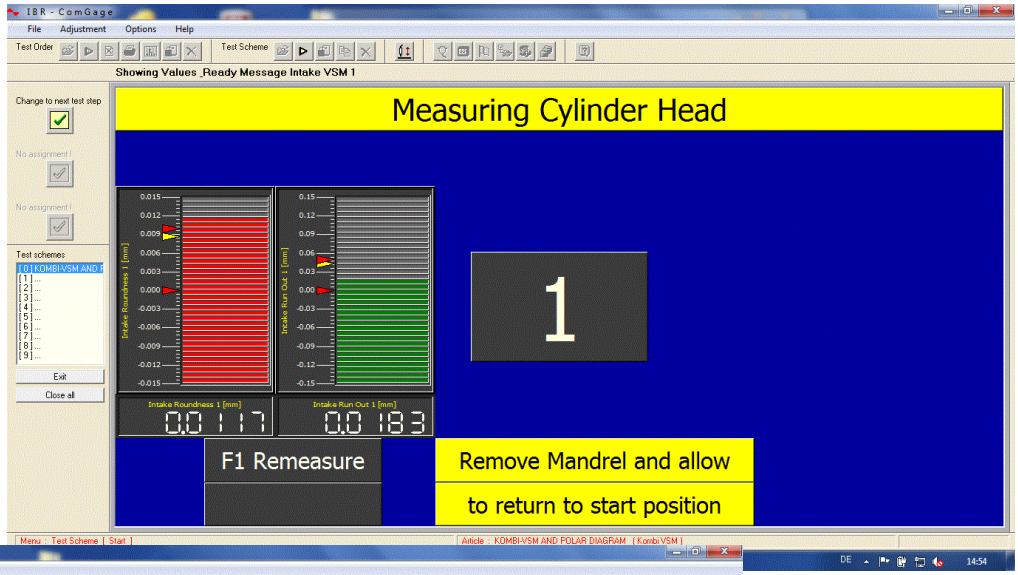
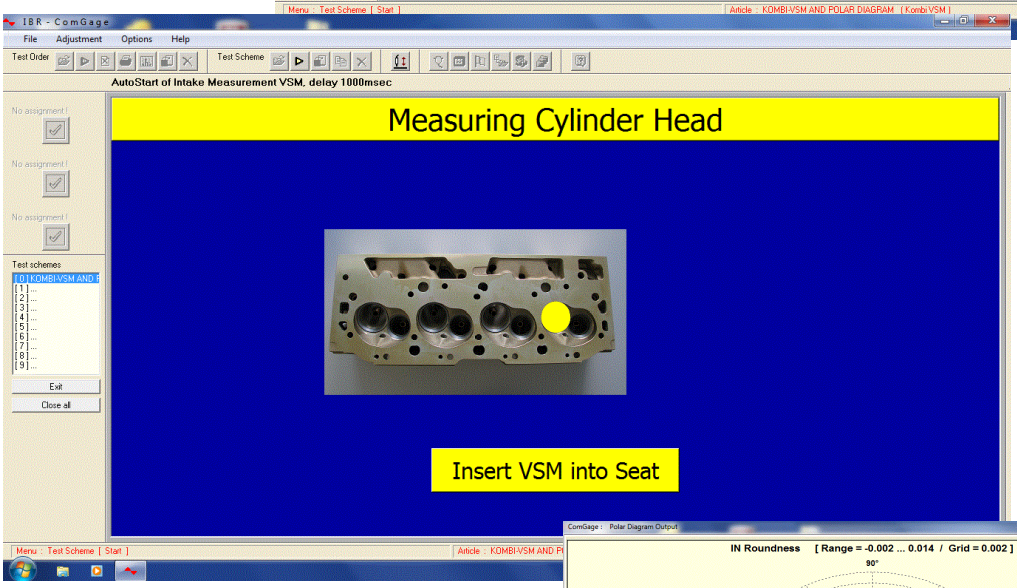
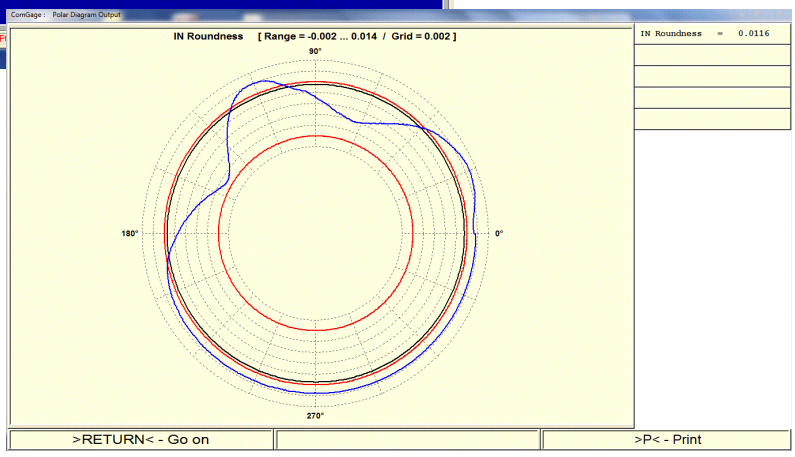
screen shots

Multiple VSM Gauge

screen shots







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