



VM E 04 2019 • © Frenco GmbH

Spline Measuring Instruments with Guiding Profile

Dimension over balls for series production parts

*pure
perfection*

FRENCO

Function

The measuring instruments VM are equipped with a guiding profile. They measure the size over two balls without reversing point. The guiding profile is matched to the gear and spline of the specimen. Thus the measuring instruments VM are single-purpose machines and only suited for the relevant series. But this is where they convince with their professionalism. They are robust, simple and the measuring results are not reliant on the operator.

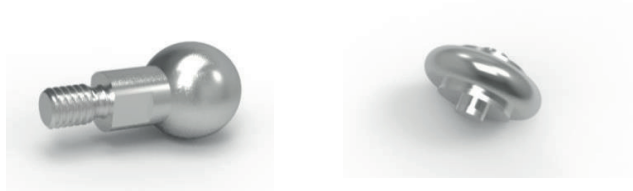
For splines the guiding profile can be supplied as go gauge profile - as under-size (in front section) or over-size profile (see below).

The choice of VM measuring instruments ranges from simple hand operated versions to the fully automatic FAPP system.

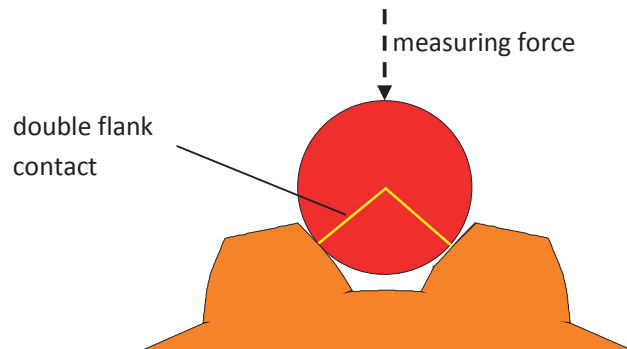
All VM measuring instruments are calibrated with a profiled setting master.

A UPM certificate contains the measuring uncertainty of the instrument and allows the ascertainment of the measuring uncertainty in daily use.

The size over two balls is measured either with measuring balls or radius disks.



The probing always occurs on double flanks.



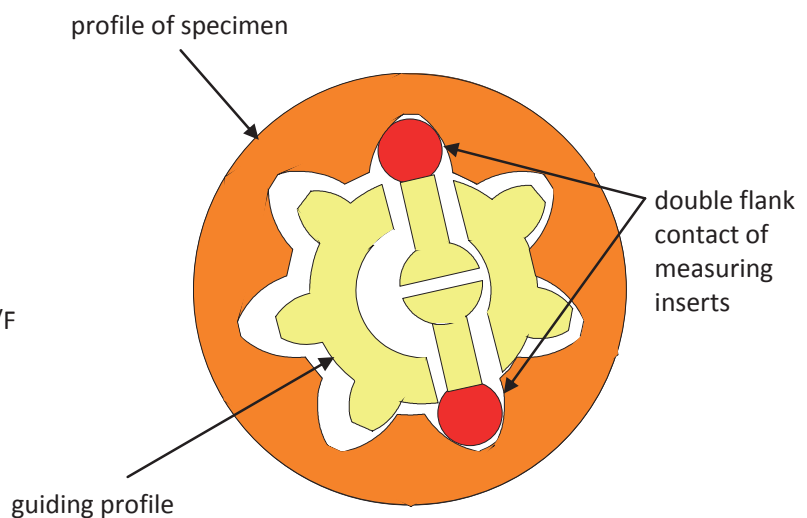
The floating suspension of the measuring inserts guarantees a double flank contact. Since the guiding profile has some clearance to the profile of the specimen, all necessary degrees of freedom are provided by the mechanical suspension.

Guiding profile

The guiding profile can be supplied:



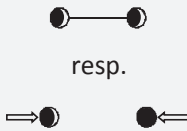
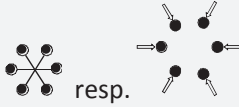


as under-size
as go gauge
as go gauge with
under-size in front section




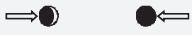








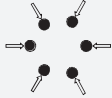




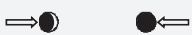
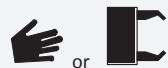



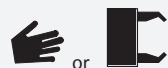




Typ VMF
Typ VML
Typ VML/F



Overview

The different instrument types have different features, which are shown in the following table.


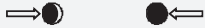

reading		dial indicator
		digital data processing
radial measuring points	 resp.	one pair, opposite internal or external
	 resp.	several pairs, opposite internal or external
measuring process		manual
		automatic

	type	picture	display	radial measuring points	measuring process
gears and splines	AVM 1x1		 or 		
	IVM 1x1		 or 		
	AVM nx2 K				
	AVM nx2 RS				
	AVM H 1x2				
	IVM nx2 RS				
Tripod	IVM 3x1 K			 special design	

Measuring Instrument AVM 1x1

AVM 1x1 instruments have a profiled guidance ring, a measuring insert with two carbide measuring balls and come with either a dial indicator or a digital measurement display. The guiding profile can also be supplied as go gauge. A measuring stand is also available for simplified handling:

The AVM 1x1 instruments are usually used for measuring medium-sized workpiece batches.

display	radial measuring points	measuring process
		



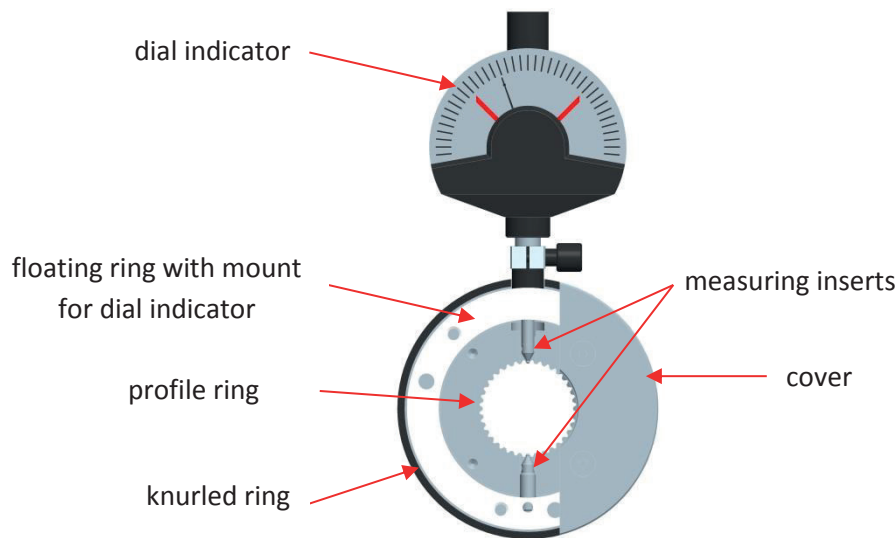
AVM 1x1
with dial
indicator

AVM 1x1 with dial
indicator and
measuring stand

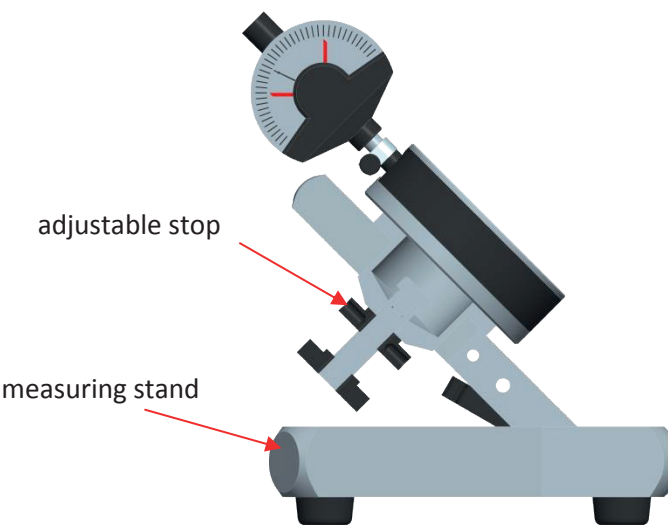


Accessories and Design

Configuration

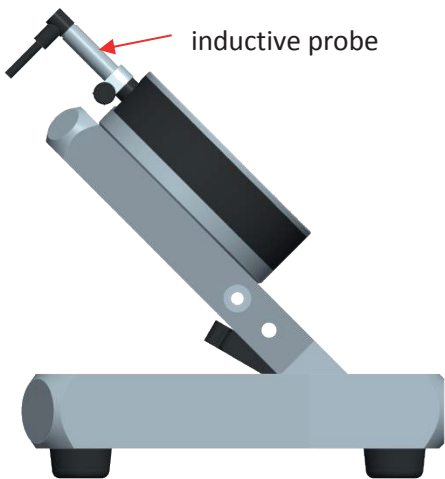


Accessory parts



Design with inductive probe

For digital data processing via illuminated bollard or software.



Accessories



control master (only necessary for inductive probes)

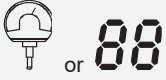

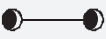



setting master (always necessary)

Measuring Instruments IVM 1x1

IVM 1x1 have a profiled guidance plug, a measuring insert with two carbide measuring balls, a handle or a measuring stand and a dial indicator or a digital display. The guiding profile can also be supplied as go gauge. Both measuring ball inserts are mechanically connected.

IVM 1x1 are mainly used for the measurement of medium-sized batches.

display	radial measuring points	measuring process
 or 		

IVM 1x1 with handle
and dial indicator

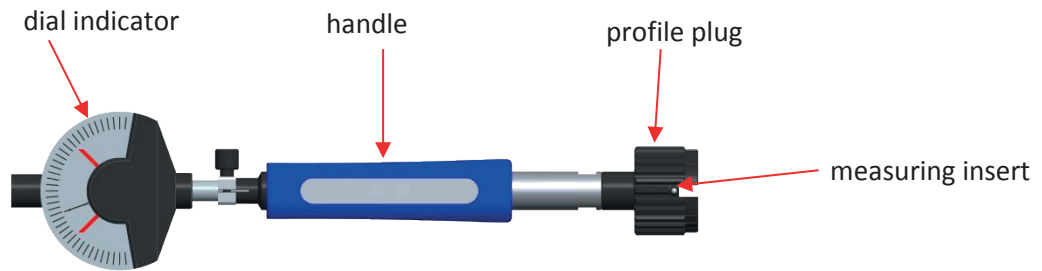


The measuring insert
can be rotated and is
suspended in pendulum
fashion.

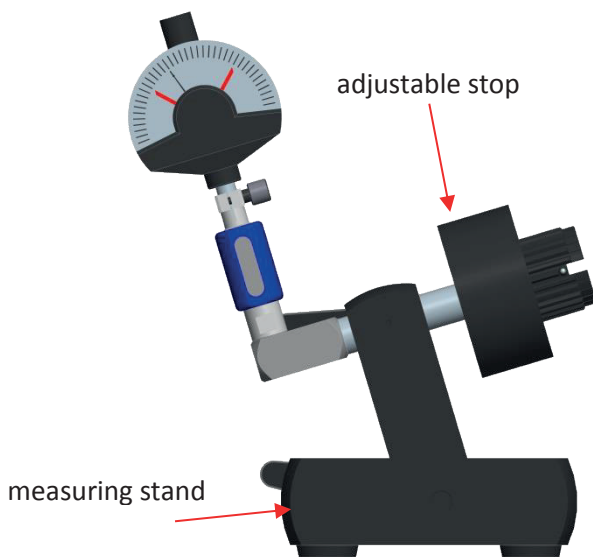


Accessories and Design

Configuration

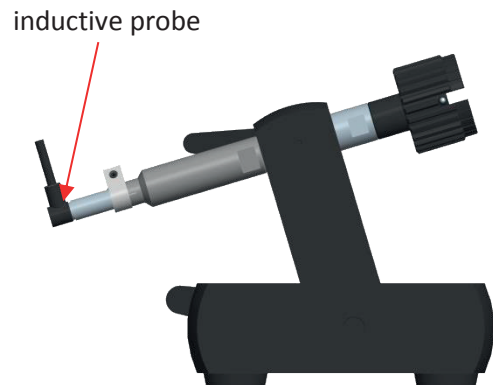


Accessory parts

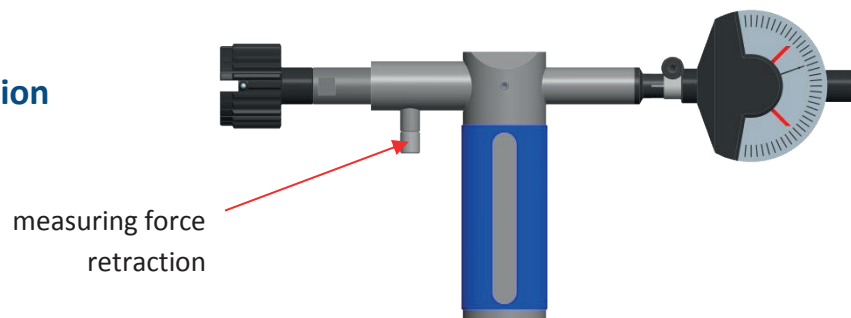


Design with inductive probe

For digital data processing via illuminated bollard or software.



Design with handle and measuring force retraction



Accessories

setting master (always necessary)

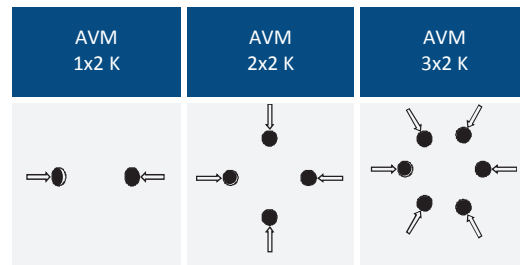


control master (only necessary for inductive probes)



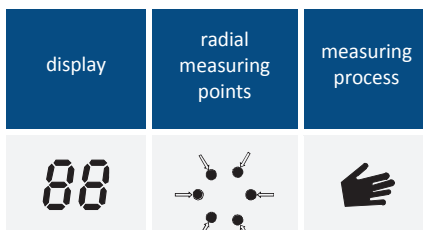
Measuring Instrument AVM nx2 K

All VM nx2 measuring instruments from Frencó have multiple measuring inserts. To determine the diametrical size over two balls, two inductive probes (located opposite each other) are added together. The types nx2 K use carbide measuring ball inserts, which are screwed into the inductive probes. Worn measuring balls can be replaced.



Due to the major wear of the measuring balls, the measuring instruments VM nx2 K are only suitable for small and medium-sized batches. Larger batches or hardened workpieces are best inspected with VM nx2 RS instruments, which work with radius disks.

AVM 3x2 K:

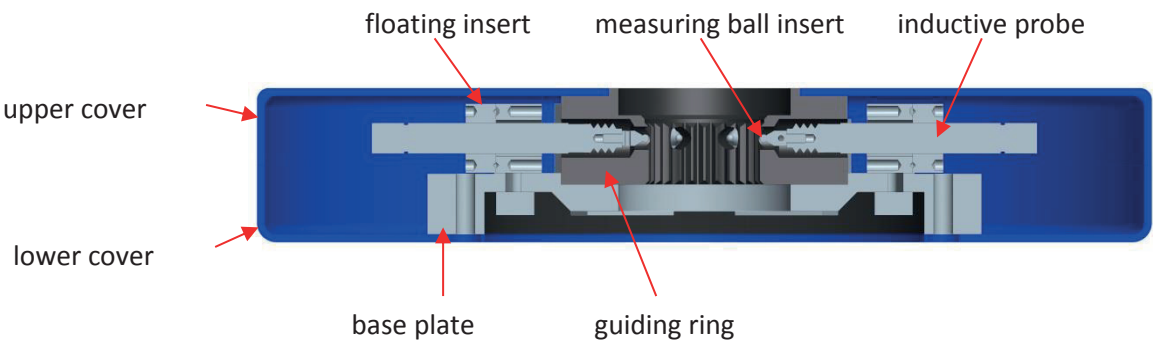


AVM nx2 K
longitudinal dynamic
adapter

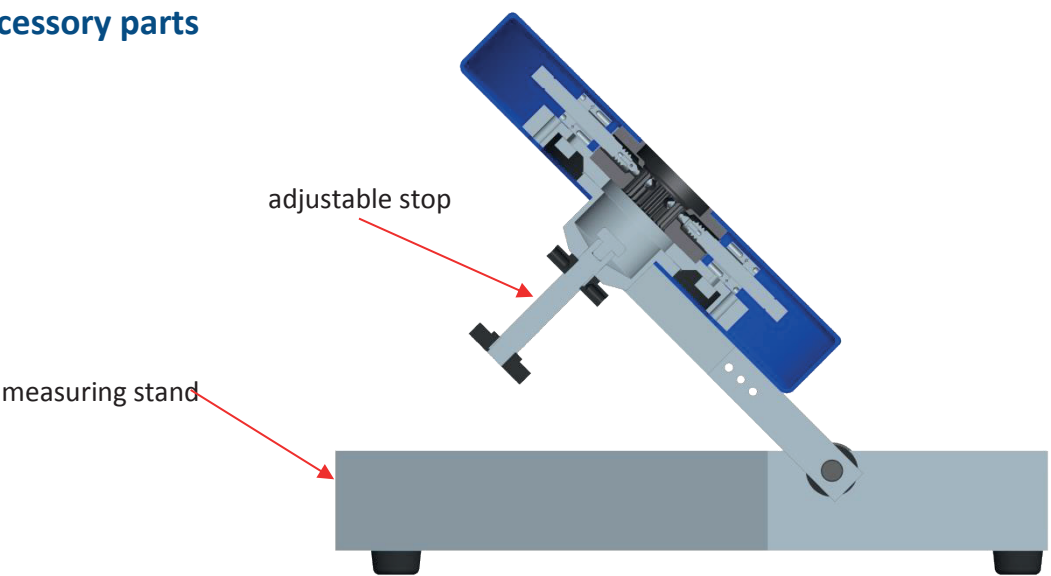


Accessories and Design

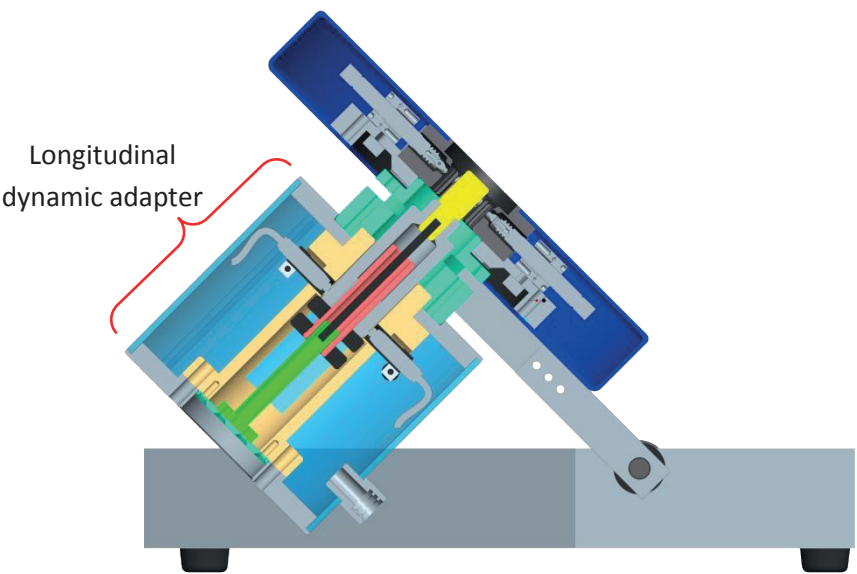
Configuration



Accessory parts



Design with longitudinal dynamic adapter



Accessories

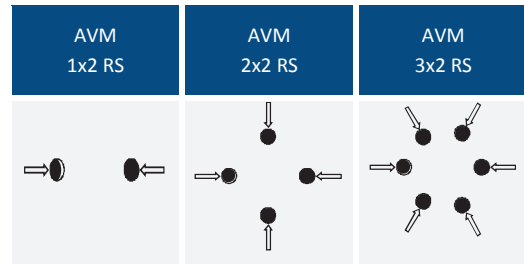
Set:
setting master (black) and
control master (blue)



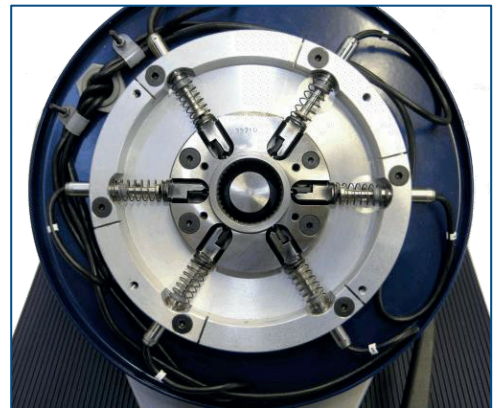
Measuring Instruments AVM nx2 RS

AVM nx2 RS instruments are working with radius disks and not with measuring balls. They are clamped in a floating insert and can be turned. The wear of radius disks is much lower than that of measuring balls. Thanks to the option of turning the disks, wear does not pose a problem. AVM RS measuring instruments have a simple design, are very robust and easy to handle.

RS instruments are suitable for automation.



AVM 3x2 RS:
3x2 floating inserts with radius disk



display	radial measuring points	measuring process
88		

AVM nx2 RS
with longitudinal
dynamic adapter

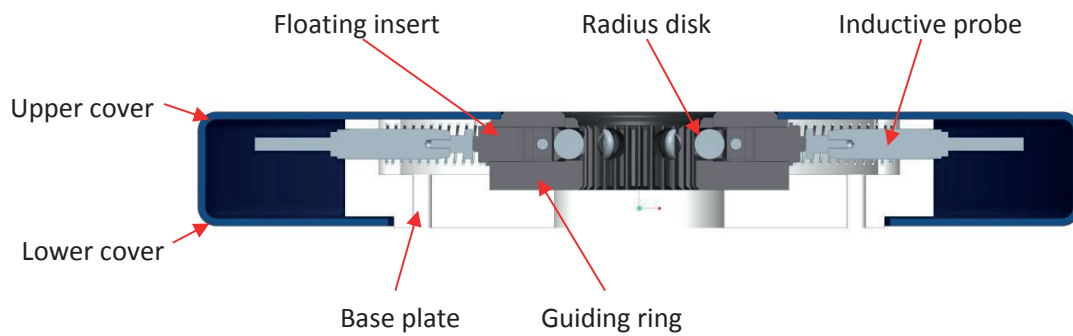


Adapter for
FAPP automation unit



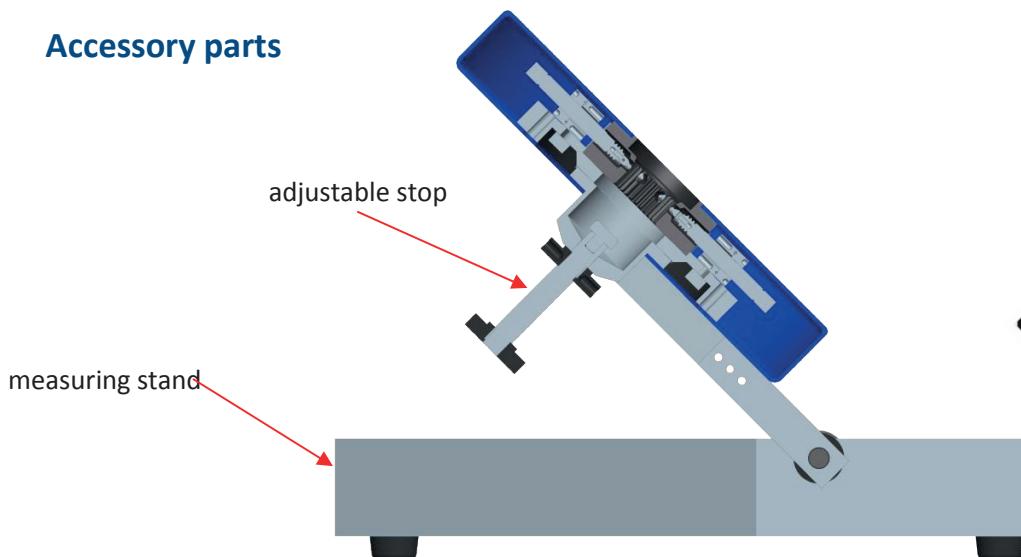
Accessories and Design

Assembly



Accessories

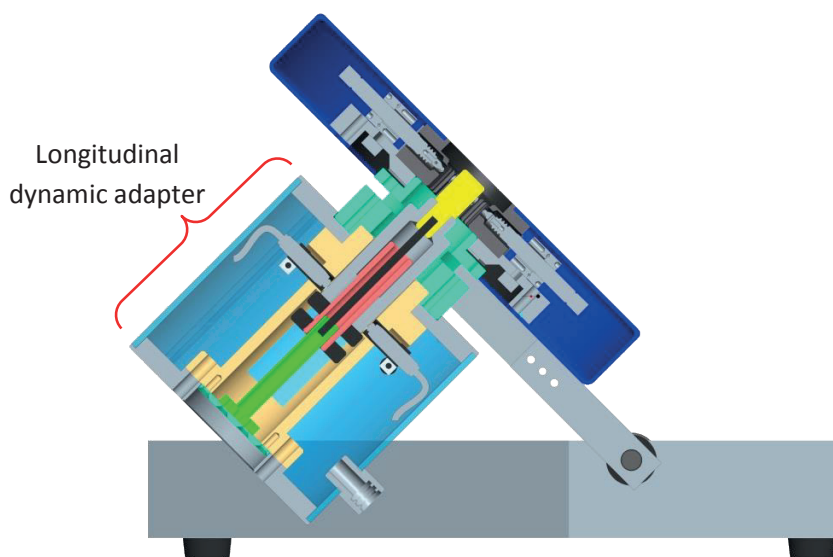
Accessory parts



Set:
setting master (black) and
control master (blue)

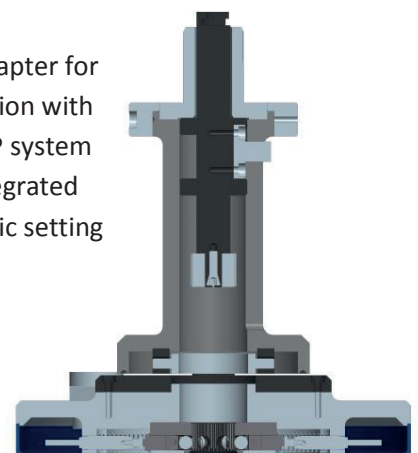


Design with longitudinal dynamic adapter



FAPP-Adapter

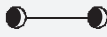


FAPP-adapter for
automation with
the FAPP system
with integrated
automatic setting
master



Measuring Instrument IVM nx2 RS

Measuring instruments with multiple measuring points for the measurement of the size between balls require, due to their limited space, some clever engineering. That is why IVM nx2 are always equipped with radius disks. The radius disks are mounted on floatingly suspended measuring levers. They are turnable if the clamping is loosened.

IVM nx2 RS are suitable for automation with FAPP-Systems.




IVM 1x2 RS	IVM 2x2 RS	IVM 3x2 RS
		

Typ IVM nx2 RS with
measuring stand



Typ IVM nx2 RS with
dynamic adaptor

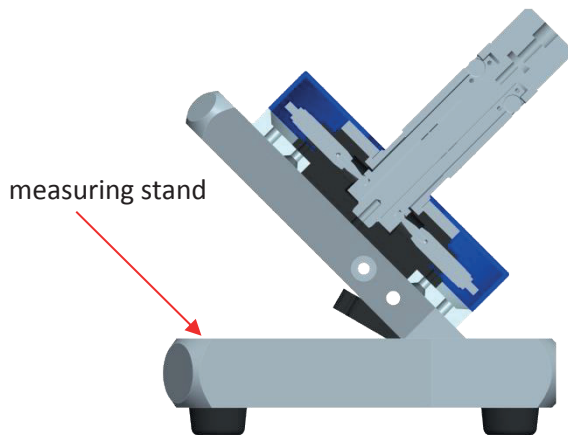
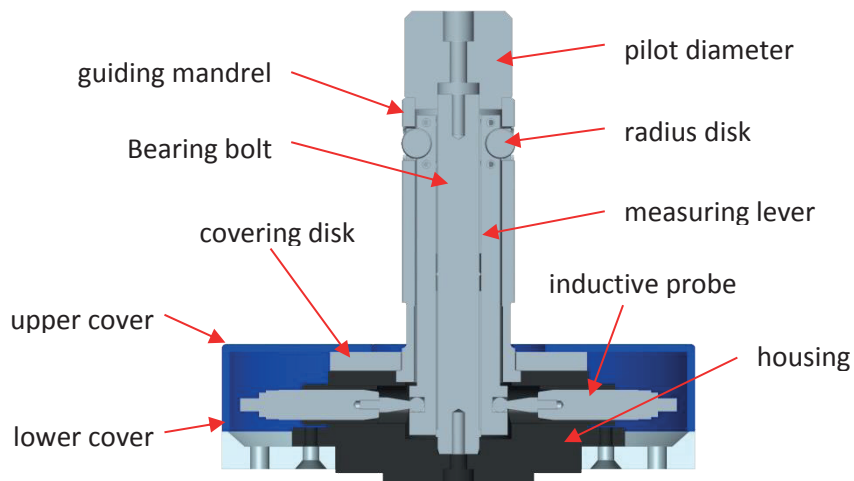


display	radial measuring points	measuring process
88		 or 



Accessories and Designs

Assembly



Accessories

setting master (black)



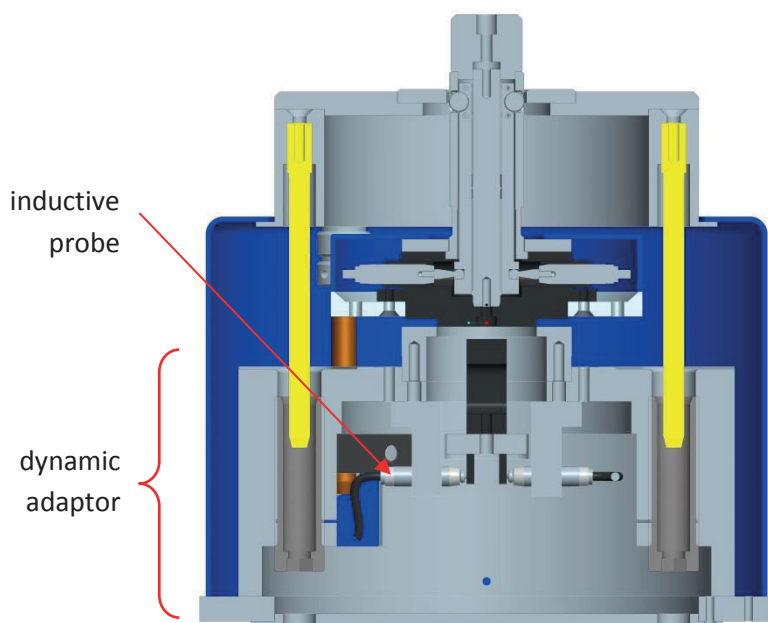
control master (blue)



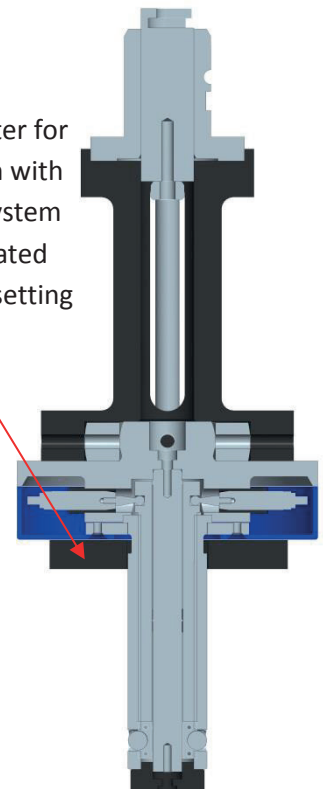
FAPP-Adaptor

for automation unit

Design with longitudinal dynamic adapter



FAPP-adaptor for automation with the FAPP system with integrated automatic setting master



Tripod Measuring Instrument IVM 3x1 K



IVM 3x1 K is used to measure tripod ball tracks. This version is only available with a longitudinal dynamic adapter.

To guarantee a best possible adaption in the ball track, the three ball insert pairs are clamped in a floating insert.

The measuring inserts for gothic contours have two-point contact. Those for the ball tracks have single-contact.



Measuring head with measuring ball inserts and distance bolt

display	radial measuring points	measuring process
88		

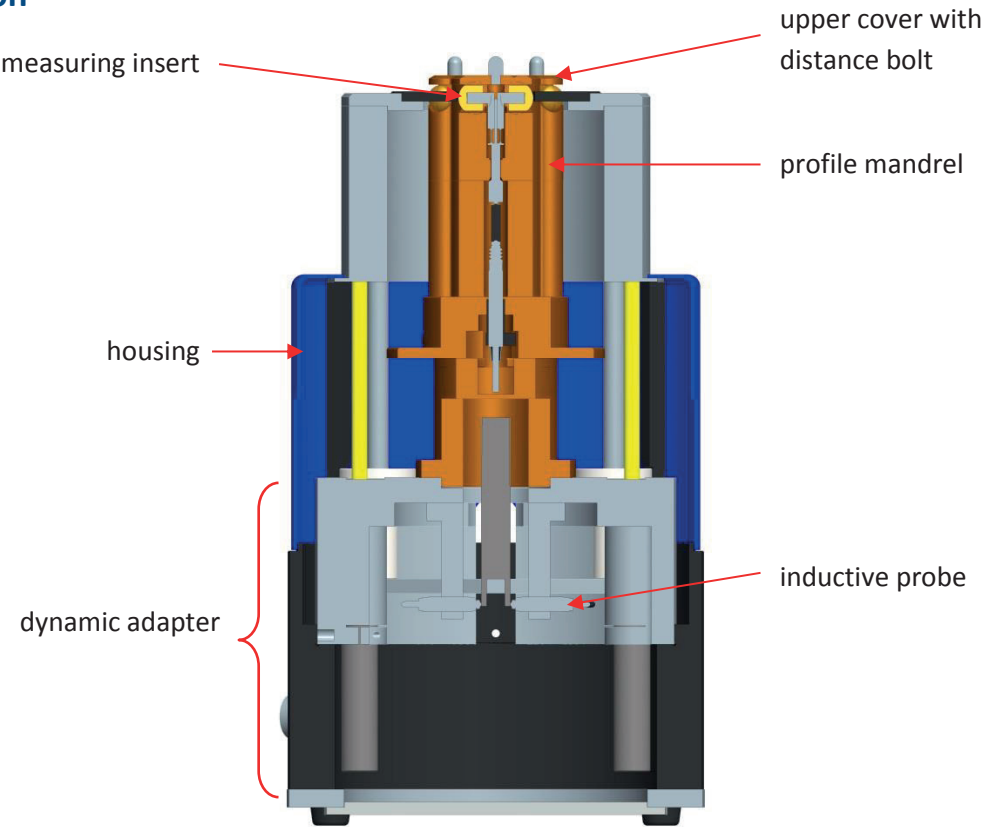
IVM 3x1 K with dynamic adapter



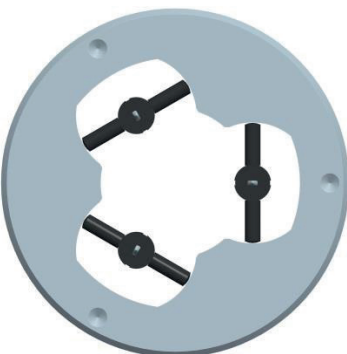
Tripod with gothic contour

Accessories and Designs

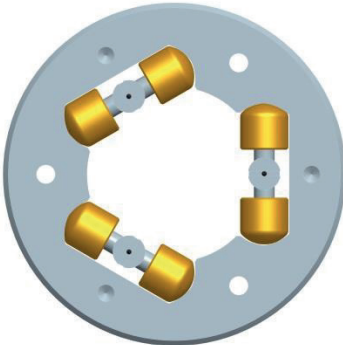
Configuration



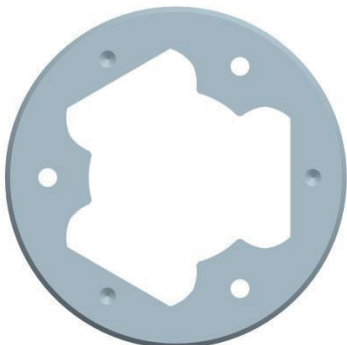
Measuring inserts:



Measuring inserts
for ball path



Measuring insert
for gothic shape



Setting and control master

Accessories:

Measurement Software LdynPro

The Frenco Gear Inspector **LdynPro** is a calculation software package for the inspection of splines using spline measuring instruments from FRENCO.

The LdynPro software offers:

- easy input of your inspection options via the menu item inspection plan
- Output of various statistical data
- Online statistic for all parameters
- Saving data in qs-STAT® format
- Keeping track of the quality of test gears over a period of time
- Different operating and output languages
- Automatically switch between different connected gauges, depending on which gauge the part is placed (in gauges with dynamic adapters)
- Text boxes for organizational information that can be freely assigned
- Determination of the following parameters:
 - o Dimension over/between balls **DoB** (+ **DoB min**, + **DoB max**) incl. range and difference
 - o taper
 - o crowning
 - o roundness
- In freely definable areas of the spline



The **DoB** test can be carried out according to the standards **DIN 5480** or **ISO 4156** with statistical evaluation (STA rule) and additional gauging test.

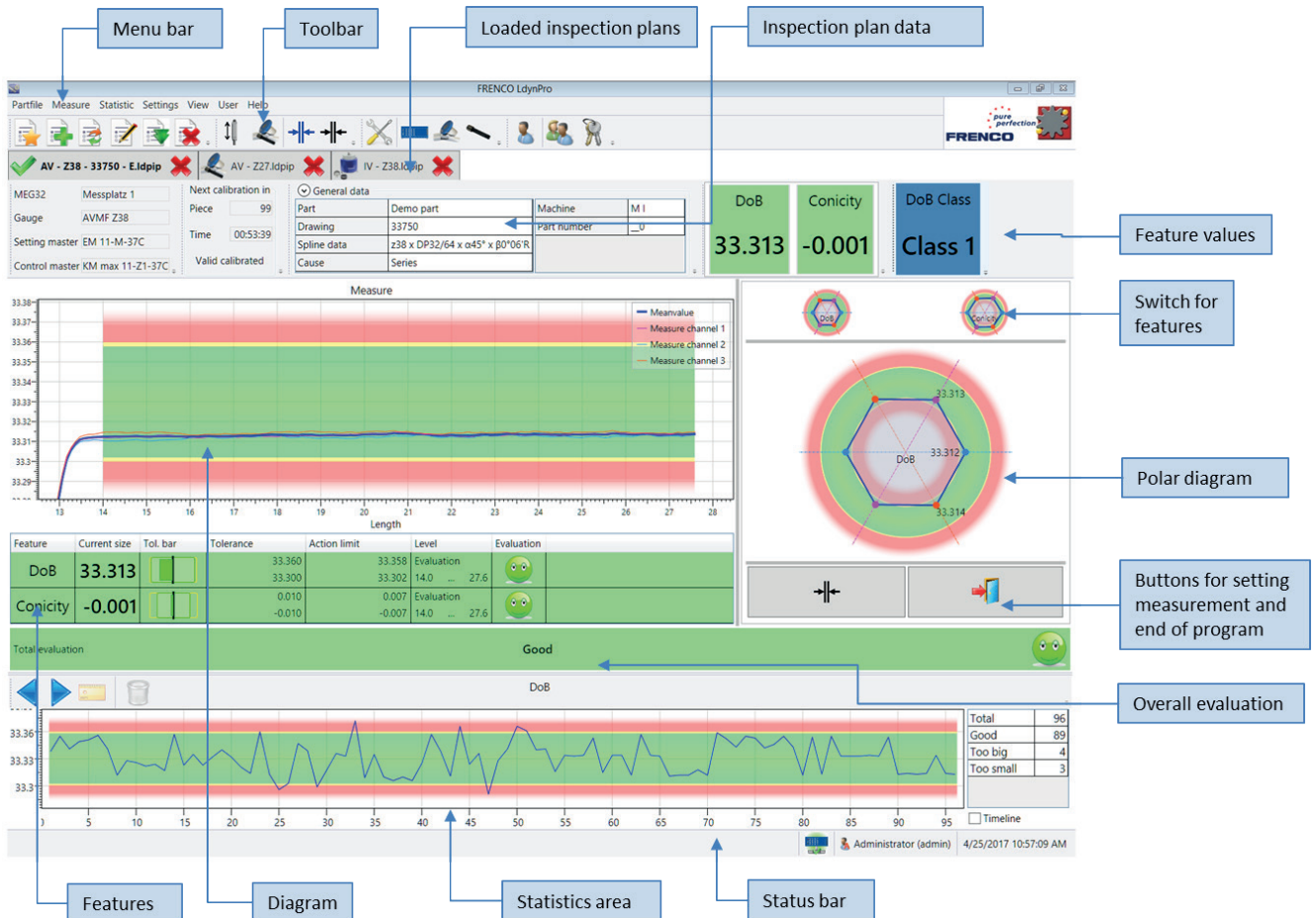
Records

A log file is created for each measurement; this file contains all inspection plan data and all of the raw data. It is therefore possible to re-evaluate the entire measurement at any time and to graphically display the results. Each inspection record can also be printed out.

Data export

The **LdynPro** software exports all calculated features in the qs-STAT® ASCII transfer format¹. The configuration of the K fields is achieved via a modifiable definition file.

Overview of the program window



The figure above shows a program window after a measurement

A colored display of measured values allows a quick evaluation of single values.

Green: Value within tolerance

Yellow: Value out of action limits

Red: Value out of tolerances

Workbench Set-Up



L-Dyn systems reach pure perfection when they are set up on a FRENCO workbench: the wiring and electronic systems are securely and invisibly stored away and the control masters are protected against damage in the drawers.

Size over two balls measurement: AVM 3x2 with horizontal sliding bench

Advantages:

- Easier handling for long workpiece shafts
- Fixed measuring plane within the longitudinal course
- Method 1: Repeatability for M_{dk} averaged $\leq 1,3 \mu m$
- Method 2: T_{min} for M_{dk} averaged = $18 \mu m$ ($R\&R \leq 20\%$)



Automation of gear and spline inspection

Two components are necessary for automation: On the one hand, the gear measuring device or the measuring head itself together with the measuring electronic MEG32 and the associated evaluation software and on the other hand the handling system which loads the parts to be tested onto the device and picked up again after the measurement.

The connection of the Frenco measuring instruments is done in two ways:

- Profibus® / Profinet ®or
- Communication by I/O Ports.

AVMH 1x2

Automatable DOP Inspection



For work pieces up to \varnothing 160 mm.

- Fast and easy machine set-up
- Automatic location of the tooth gap
- Very robust design
- Suitable for robot loading directly in the production machine

FAPP 1E

Automated inspection of splines



- Longitudinal measuring system for internal and external splines
- Electrically adjustable setting master
- Motor-controlled turn-in movement of the measuring gauge

For FAPP 1 E Frenco is producing the measuring unit and the measurement software. The FAPP 1E incl. the handling system is distributed by Fa. Eckart Anlagenbau GmbH.



Pure Perfection. Since 1978.

Experience, competence and innovation in gear metrology.



Our Products:

Spline Gauges | Toothed Artefacts and Masters | Master Gears |
Tools and Clamping Systems | Size Inspection Instruments |
Double Flank Gear Inspection | Gear Flank Analyser | Universal
Measuring Machines | Rack Inspection Machines | Software

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