



SUBITO®
AND VARIANTS

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546 avenue des Amaranches
ZAC Ecotec - F-74460 MARNAZ
Tél. 04 50 982 905 | info@pms-becus.com

PMS BECUS
MÉTROLOGIE

**Echwenk**

Content

CONTENT

The SUBITO® is an internal precision measuring instrument, which is based on a construction principle well-established since over 90 years. Its quality and reliability have convinced experts all over the world.

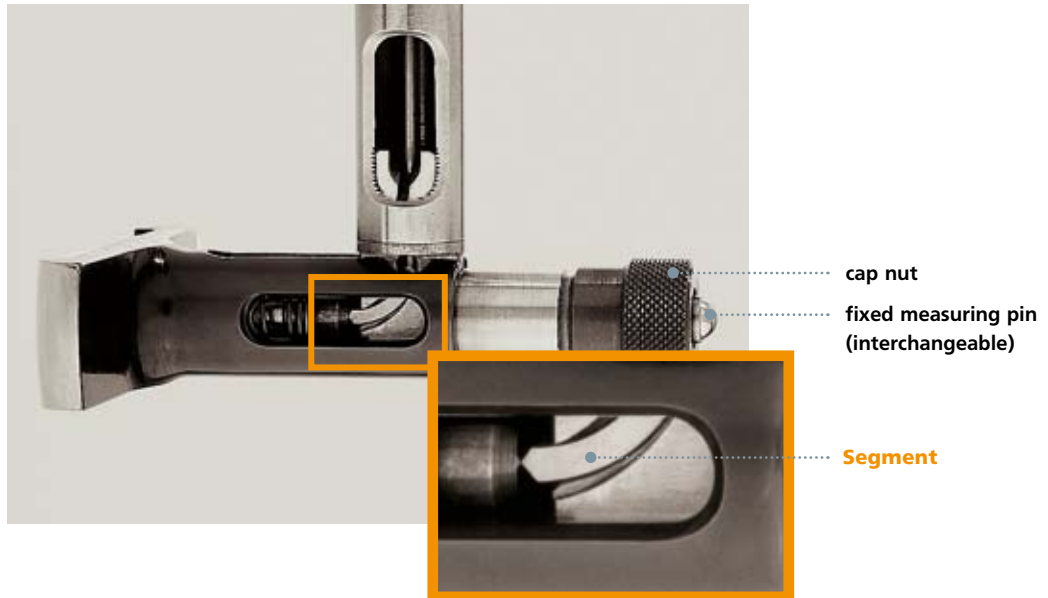
The SUBITO® comparator gauge serves for the measurement of cylindrical bores with a diameter from 4,5 up to 800 mm (standard) as well as their deviations in form. For the indication of the measuring value precision indicators, mechanical and electrical dial gauges or electronic probes can be used.

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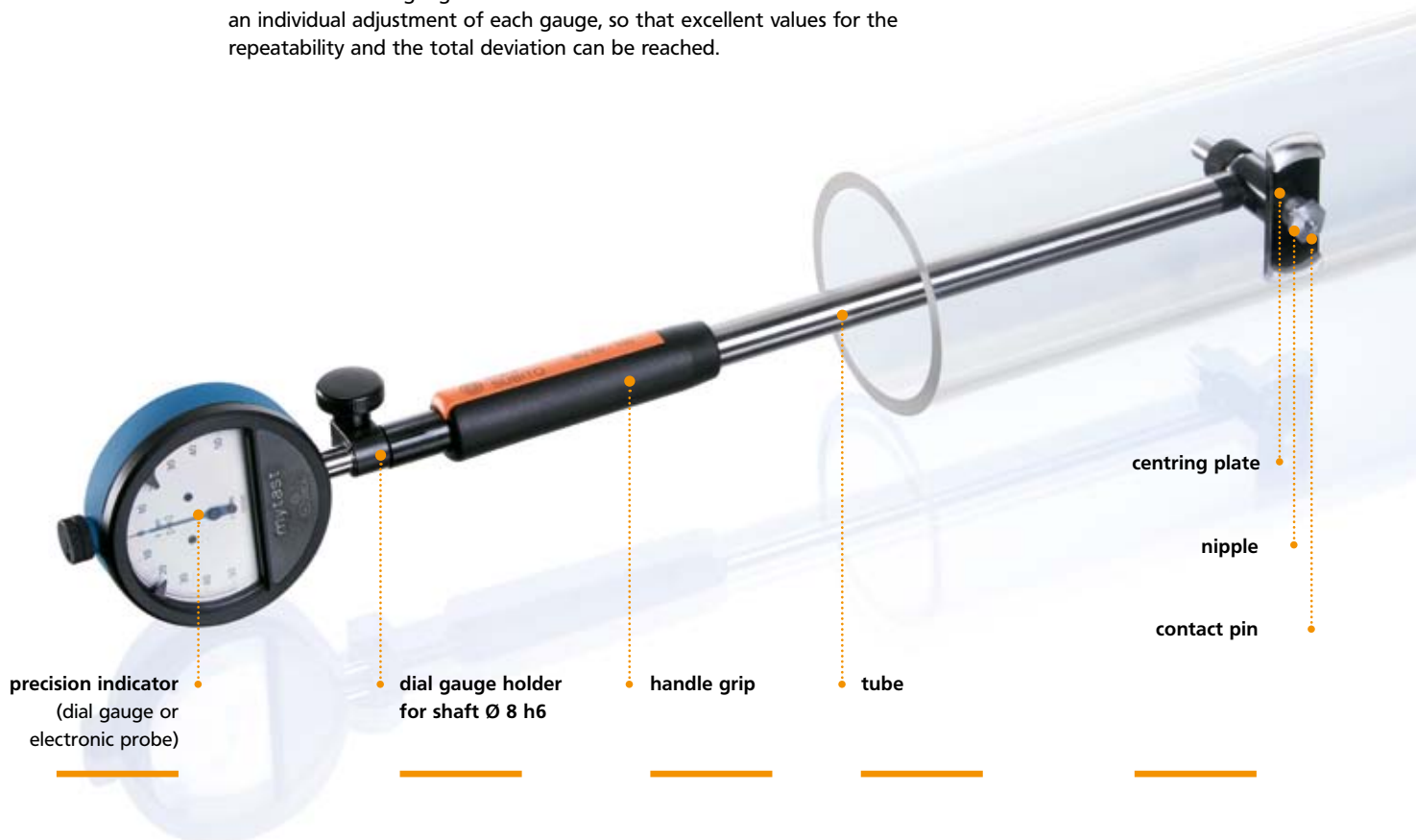
Basic information

SUBITO® SEGMENT



Segment

This high-precision deviation element, developed and patented by SCHWENK decades ago, is the core piece of the SUBITO®. The segment ensures a transmission free of backlash of the contact pin travel to the connecting rod in the tube of the gauge and therefore on the indicator. This element allows an individual adjustment of each gauge, so that excellent values for the repeatability and the total deviation can be reached.





Application possibilities

BORE MEASUREMENT WITH SUBITO®



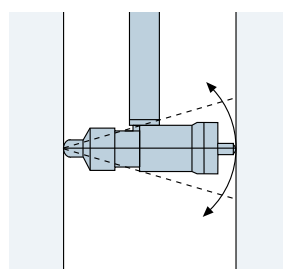
Application possibilities

Bore measurement with SUBITO®

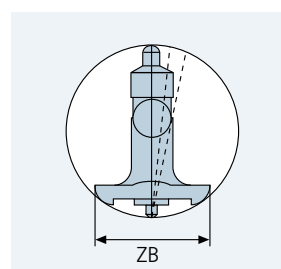
The SUBITO® is an universal and rugged two-point contact comparator instrument for the use in the room for precision measuring, in the production as well as in the incoming and final inspection. It is suitable for measuring tasks with highest demands on accuracy in the single as well as in the series production. The easy handling of the measuring instrument enables a reliable measuring process.

The centring of the SUBITO® in the bore is made automatically; the base is the centring plate with width ZB. The wider the centring base ZB the more reliable the gauge is centred in the bore. This fact has already been taken into consideration in 1921, when defining the application ranges which are valid until today.

When measuring with the SUBITO® the so-called reversal point has to be searched. This is made by oscillating the measuring instrument over the fixed measuring pin. Thus, the position with the minimum value is passed through, at which the axis of the measuring instrument is exactly vertical to the bore axis. With a mechanical indicating unit this is clearly visible at the change of direction of the pointer. When using a digital display unit a minimum value storage is helpful.

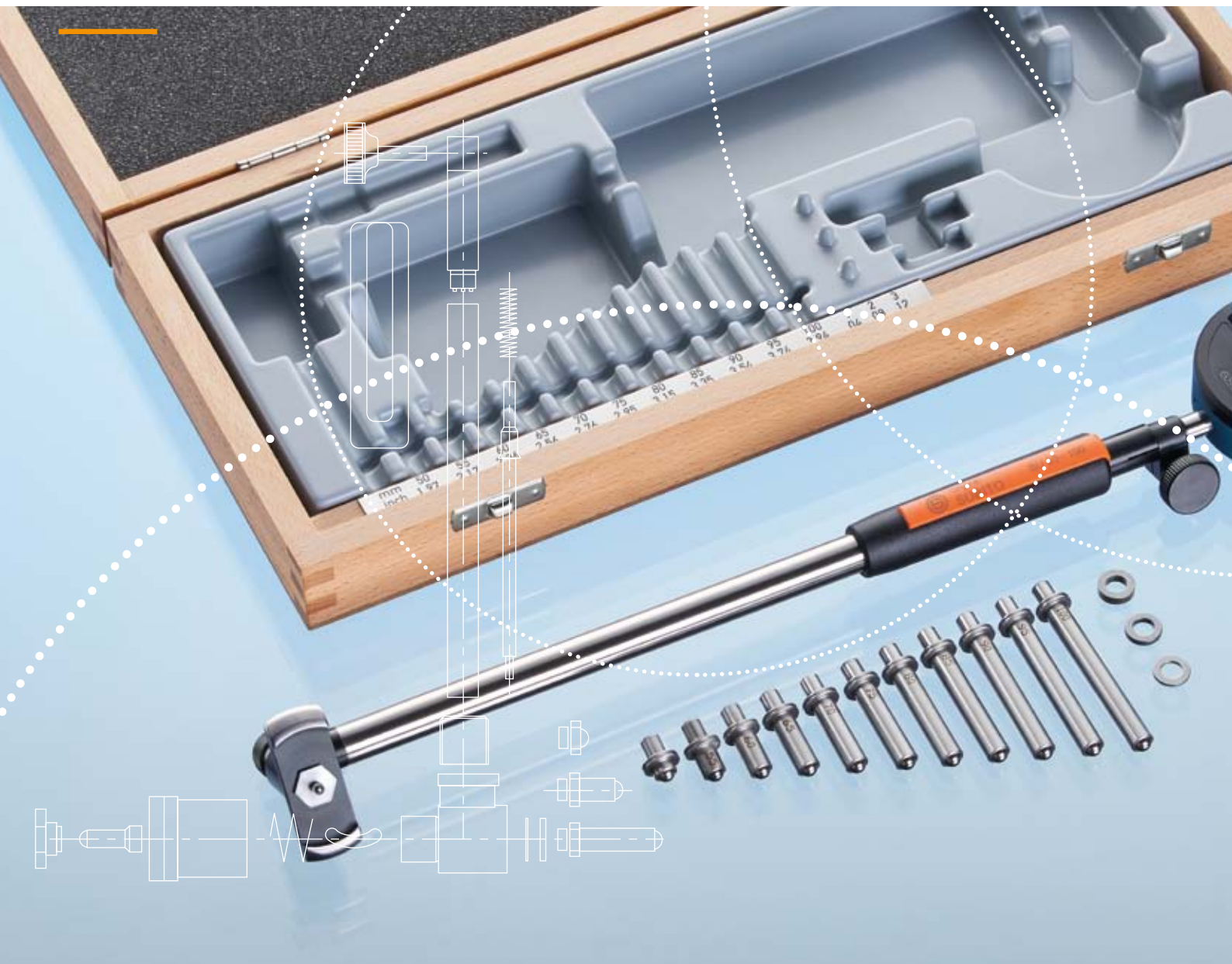


oscillating process



centring process

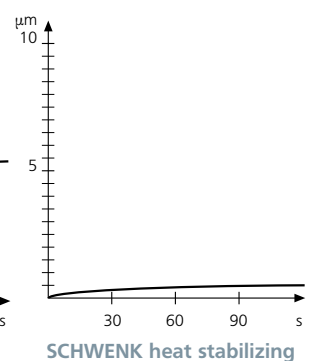
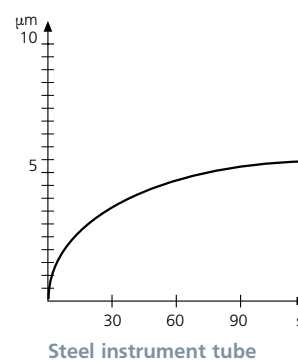
SUBITO® SU 50-100



Accessories

- plug-in measuring depth extensions MTV out of Invar suitable from \varnothing 35 mm (standard length: graduated from 250 up to 2000 mm)
- measuring range extensions
- special measuring pins, e. g. for in-between sizes, hard-chrome plated, fitted with ruby or ceramics, larger measuring radii for rough surfaces
- special centring plates, e. g. with a coating or for special profiles
- setting device ESU
- master setting rings for all diameters (up to \varnothing 300 mm)
- prompt spare part and repair service
- calibration service for all SCHWENK measuring instruments:
manufacturer calibration report on request
- various solutions for special measuring problems
- dial gauge holder for a clamping shaft 3/8"
- SUBITO® for diameters $>$ 800 mm

Effects of the hand heat on the measuring result



General remarks

ADVANTAGES, ACCESSORIES



Advantages

Highest precision

The precision of a comparator gauge is shown clearly with the repeatability. For the SUBITO®, this is within 0,5 μm . Furthermore, a deviation of max. 2,0 μm over the complete measuring range of a gauge is reached (each up to \varnothing 290 mm). The segment is mainly responsible for this high precision. Moreover, the Invar tube (with special nickel alloy) makes the gauge very insensitive to sources of heat such as hand-heat or high ambient temperature.

High measuring certainty

This is reached by the subdivision into 11 ranges of application with diameter between 4,5 and 800 mm.

Easy handling

With the SUBITO® it is possible to effect measurements at any position. The gauge effects a self-centring through the spring-loaded centring plate. The search for the reversal point during the oscillating process leads to a clearly visible and exactly repeatable measuring result.

Extensive range of application

The simple exchanging of the pins and increment washers allows the instrument to be adapted easily to other diameters, so it is able to cover an extensive range of application.

Reliable determination of deviations in form

By rotating or moving the gauge inside the bore, form deviations as e. g. deviations of roundness or cylindricity are determined (thus far as possible with the two-point contact comparator method).

High service life/robustness

The SUBITO® contact pins are fitted with tungsten carbide balls as standard. Measuring pins as an option. All inside wearing parts are made either of tungsten carbide or of wear resistant and hardened steel. The segment deviation enables a certain degree of insensitivity to shocks. In contrast to other deviation principles, the segment deviation is very easy to maintain, adjustable and robust.

Easy setting

As dimensional reference for the setting of the SUBITO®, the following devices are used in practice: master setting rings, gauges, micrometer screws. Also the SCHWENK setting device ESU, used together with precision gauge blocks, developed by SCHWENK, is suitable therefore.

The ESU is fitted with setting jaws, especially adjusted to the centring plate of the different SUBITO® sizes. These setting jaws allow a reliable calibration of the gauge. The measuring certainty of each comparator gauge always depends on the precision of the measurement reference used.

Versatility

Many variants of precision measuring instruments which are described on the following pages are based on the proven measuring principle of the SUBITO®.

With the SUBITO® series SU/SK, a manufacturer calibration report is included free of charge.

SUBITO® holder SU/SK

If you want to measure only one or a few defined diameters with a SCHWENK gauge it is not necessary to buy a complete measuring instrument in a wooden box. The most economical solution therefore is a SUBITO® holder, i. e. just the measuring instrument without the measuring pins and without wooden box. The necessary measuring pins, also with special length, need to be ordered separately.

Technical data SU/SK

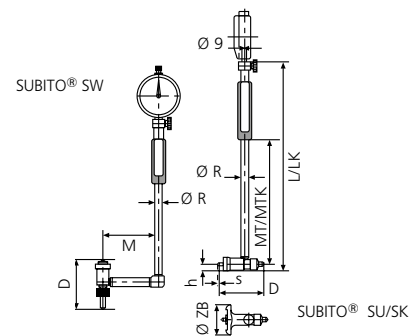
range of application	4,5 - 290 mm	range of application	280 - 800 mm
repeatability	$f_w \leq 0,5 \mu\text{m}$	repeatability	$f_w \leq 1,5 \mu\text{m}$
max. deviation	$f_e \leq 2 \mu\text{m}$	max. deviation	$f_e \leq 3 \mu\text{m}$



SUBITO® holder

SUBITO® angled SW

By an angle piece fixed in the instrument tube it is possible to measure also bores which are difficult to reach. Inside the angle piece another segment is integrated so that the transmission of the contact pin travel is affected almost without friction.



SELECTION CRITERIA FOR SUBITO® SU/SK/SW

Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
from	4,5	6	8	12	18	35	50	100	160	280	400	
to	6	8	12	20	35	60	100(150)	160(230)	290(360)	410(510)	800	
travel s	0,35	0,5	0,7	0,9	1,3	1,3	1,4	1,6	1,6	2,6	2,6	
measuring depth MT	80	100	100	114	116	179	179	235	235	417	417	
measuring depth MTK	24	24	24	24	26	22	22	30	29,5	55	-	
angle measuring depth M	30	30	30	52	52	62	62	75	75	80	-	
total length L	147	165	166	199	201	294	295	367	367	548	548	
total length LK	90	90	90	109	111	140	141	162	162	208	-	
tube Ø R	4	5	5	8	8	12	12	18	18	24	24	
centring plate width ZB	4	5,2	6,5	9	14,8	28	45	75	120	156	300	
front distance h	2	2,6	3,25	4,5	5,4	8,5	8,5	11,5	11,5	16	18	
number of measuring pins	9	7	9	9	9	6	11	7	7	7	11	
number of increment washers	-	-	-	1	2	3	3	4	4	4	4	
extensions quantity/length	-	-	-	-	-	-	(1)/50	(1)/70	1(2)/70 (70)	1(2)/70 (100)	(3)/100	

Technical data SW

range of application	4,5 - 290 mm	range of application	280 - 800 mm
repeatability	$f_w \leq 1 \mu\text{m}$	repeatability	$f_w \leq 2,5 \mu\text{m}$
max. deviation	$f_e \leq 4 \mu\text{m}$	max. deviation	$f_e \leq 5 \mu\text{m}$

SUBITO® plane parallel SP

The SUBITO® SP serves for the flexible and precise measuring of plane parallel distances. The overall application range is from 18 to 200 mm. The SUBITO® SP is based on the SUBITO® SU, therefore the technical data is identical. The SP centring plate can also be ordered separately for a later conversion of the SUBITO® SU.

SELECTION CRITERIA FOR SUBITO® SP

Range of application D	[mm]	[mm]	[mm]
from	18	50	50
to	50	100	200
centring plate width ZB	17	49	49
extensions quantity/length	1/(16)	-	2/(50)



SUBITO® SW angled



SUBITO® SU (top) and SUBITO® SP (below)

Measuring depth extension **MTV**

The use of a plug-in measuring depth extension MTV is recommended when needing to extend the measuring depth of a SUBITO® only now and then. The MTV are suitable from Ø 35 mm and are made out of Invar steel. Therefore the influence of the ambient- or hand-heat on the measuring result is minimized. The MTV are available with tube Ø 12 and 18 mm, as well as in different length up to 2.000 mm.



Measuring depth extension
MTV

SUBITO® special measuring depth/ deep bores measuring instrument **SMT/SE**

If it is necessary to measure continually in deep bores we recommend an instrument with a corresponding measuring depth. The measuring accuracy obtained with a SMT is higher than with the use of a plug-in measuring depth extension MTV (friction loss). Furthermore, the SMT model is more robust than the SUBITO® with a MTV plugged-in.

SMT: max. measuring depth 3.000 mm

SE: max. measuring depth ≤ 12.000 mm

(depends on the Ø to be measured)



SUBITO® SMT, SU, SK

SUBITO® for blind bores **SS**

With the SUBITO® SS it is possible to measure bores very close to the bottom and short centring shoulders, as well as their deviations in form, e. g. their roundness and cylindricity. The range of application is from 20 to 600 mm, divided into three instrument sizes. The minimum distance from the bore bottom is „h“ = 1,0 mm. During the measuring process, the device is lying on the bore bottom so that it is not necessary to search the reversal point by oscillating the gauge. The construction of the SUBITO® SS is based on the proven and unsurpassed measuring principle of the standard SUBITO®, the adjustable segment deviation. The pre-setting of this comparator gauge is affected by changing or sliding the toothed and scaled measuring slides. The measuring contacts are out of tungsten carbide, alternatively ruby. The fine setting can be made with setting rings, master pieces or the setting device ESU with special setting jaws for the SS.

Technical data **SS**

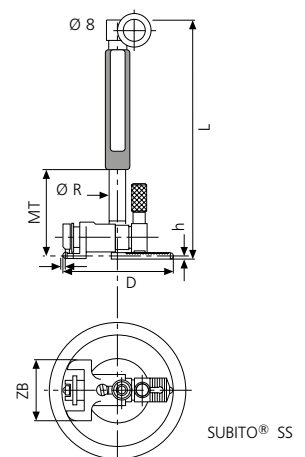
range of application	20 - 600 mm		
repeatability	$f_w \leq 1,0 \mu\text{m}$		
max. deviation	$f_e \leq 4,0 \mu\text{m}$ (SS 20-50)		
	$f_e \leq 2,5 \mu\text{m}$ (from SS 50-110)		

SELECTION CRITERIA FOR SUBITO® SS

Range of application D	[mm]	[mm]	[mm]	[mm]
from	20	50	110	300
to	50(60)	110(140)	300(400)	600
travel s	1,5	1,5	1,6	1,6
measuring depth MT	77	55	45	45
total length L	163	147	163	163
tube Ø R	10	12	18	18
front distance h	1,5/1,0	1,5/1,0	2,0/1,0	2,0/1,0
centring plate width ZB	18	34	81	140
number of measuring slides	3(4)	2(3)	4(6)	6



SUBITO® SS for blind bores



SUBITO® SS

SUBITO® Vario SV

This type is an economical combination of main components of different gauge sizes for covering an extensive range of application from 6 to 800 mm. This universal useable modular system is very suitable for measuring tasks which are often changing within a wide measuring range. This can be done by changing the measuring heads and the according measuring pins. A SUBITO® Vario gauge consists of the instrument upper part and 1 to 2 measuring heads. All advantages of the SUBITO® are analogous for the instruments of the series SV, therefore the high precision and measuring accuracy are kept. In case of spare part order it should be taken into consideration that the Vario gauge is partly fitted with other components than the standard SUBITO®.



SUBITO® Vario SV

SELECTION CRITERIA FOR SUBITO® SV

Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
from	6	10	18	50	160	400
to	10	18	50	160	430	800
travel s	0,5	0,75	1,3	1,4	1,6	2,6
measuring depth MT	100	102	145	147	180	180
angle measuring depth M	36	36	82	84	-	-
total length L	165	169	247	252	332	342
tube Ø R	5	5	10	10	24	24
centring plate width ZB	5,2	8,5	14,8	45	120	300
front distance h	2,6	4,25	5,35	8,5	11,5	17,5
number of measuring pins	8	9	9	11	7	11
number of increment washers	1	1	2	3	4	4
extensions	-	-	(1)/16	(1)/55	(3)/70	(3)/100

SUBITO® Vario system SVS

This is the instrument type which is most universal, useable for diameters from 18 to 160 mm. For the SVS system everything is valid, which has already been mentioned for the system SV. Two SUBITO® blind bore measuring heads are additionally included in the delivery volume of the SVS and are fitted with the corresponding tungsten carbide tipped measuring slides for a range of 20 to 140 mm. These SUBITO® SS measuring heads can also be screwed into the (short) upper part of the gauge. Therefore, a bore measurement starting at 1,5 mm from the bottom of the bore is possible.

Accessories for SV/SVS:

- screw-in measuring depth extensions SV-MTV to reach higher measuring depths
- angle piece for bores difficult to reach
- setting device ESU

Technical Data SV

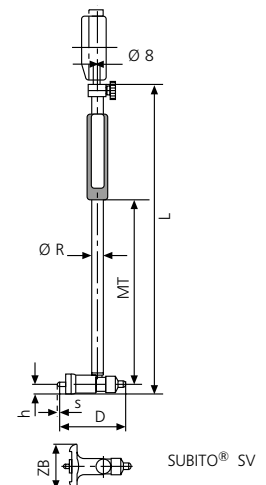
range of application	6 - 160 mm	range of application	160 - 800 mm
repeatability	$f_w \leq 0,5 \mu\text{m}$	repeatability	$f_w \leq 1,5 \mu\text{m}$
max. deviation	$f_e \leq 2 \mu\text{m}$	max. deviation	$f_e \leq 3 \mu\text{m}$

SELECTION CRITERIA FOR SUBITO® SVS

Range of application D	SV [mm]	SV [mm]	SS [mm]	SS [mm]
from	18	50	20	50
to	50	160	50	140
travel s	1,3	1,4	1,5	1,5
measuring depth MT	28	30	93	42
angle measuring depth M	82	84	143	94
total length L	130	132	186	138
tube Ø R	10	10	10	10
centring plate width ZB	14,8	45	18	34
front distance h	5,35	8,5	1,5	1,5
number of measuring pins	9	11	3	3
number of increment washers	2	3	-	-
extensions	(1)/16	(1)/55	-	-



SUBITO® Vario-System SVS



SV - depth extension **SV-MTV**

Accessories for SV/SVS: screw-in depth extensions

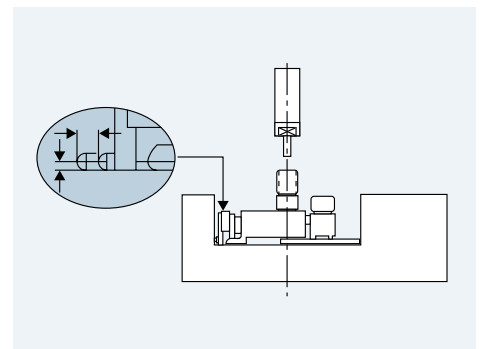
Compared to the system SUBITO® SU the measuring depth extensions MTV can be screwed in for the system SV/SVS. Moreover, they are possible from Ø 6 mm already. Up to Ø 160 mm the MTV come only out of Invar steel. Larger lengths are available out of carbon as an option. Both designs can be ordered in different lengths.



Measuring depth extension SV-MTV

SUBITO® blind bore vario **SSV**

This type is an economical solution to measure blind bores so that in total a range of application from 20 to 140 mm is covered. The SSV consists of one upper part and two screw-in blind bore measuring heads as well as the corresponding measuring slides. Here it is also possible to effect measurements starting at 1,0 mm from the bore bottom.



Measuring head SUBITO® SS

RABITO precision measuring instrument **RA**

The RABITO is a comparator gauge to measure bores from 18 to 300 mm diameter. The design is based on the well proven principle of the SUBITO®, the transmission of the travel is via a segment. Whereas the original SUBITO® is designed to satisfy the highest quality requirements, the more cost efficient RABITO was conceived to meet high accuracy demands.

Technical Data RABITO

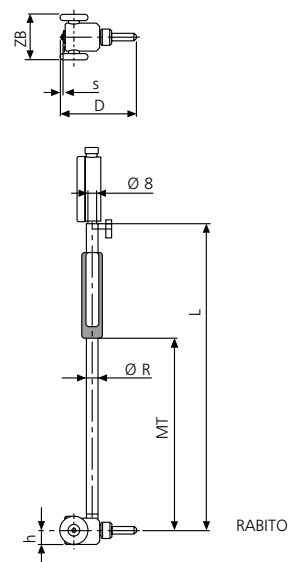
range of application	18 - 300 mm
repeatability	$f_w \leq 1 \mu\text{m}$
max. deviation	$f_e \leq 4 \mu\text{m}$

SELECTION CRITERIA FOR RABITO

Range of application D	[mm]	[mm]	[mm]	[mm]
from	18	35	50	150
to	35	60	150	300
travel s	1,3	1,3	1,4	1,4
measuring depth MT	176	178	178	178
total length L	289	286	298	298
tube Ø R	12	12	12	12
front distance h	7,25	10,5	13	13
centring plate width ZB	14,5	28	43	77
number of measuring pins	9	6	11	11
number of increment washers	2	3	3	3



RABITO 50-150



CITO 3P precision measuring instrument CI

The CITO 3P is a flexible and easy to use two-point measuring instrument which is as easy to use as a three-point internal measuring instrument due to the automatic and complete centring - measuring without oscillating. It can be easily adapted to different diameters due to exchangeable measuring pins. The total application range of 20 to 170 mm is subdivided over 5 instrument sizes. The CITO 3P suits the requirements of the DIN EN ISO 8015 which demands a two-point measuring if not otherwise specified on the drawing. Point-shaped contacts out of tungsten carbide enable also the determination of deviations in form like cylindricity and elliptical roundness error.

Technical Data CITO 3P

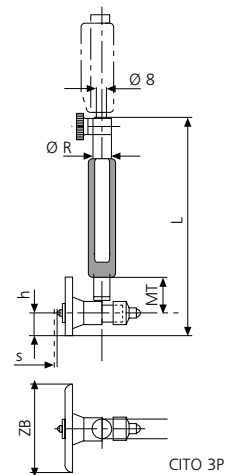
range of application	20 - 170 mm
repeatability	$f_w \leq 1 \mu\text{m}$
max. deviation	$f_e \leq 2 \mu\text{m}$



CITO 3P

SELECTION CRITERIA FOR CITO 3P

Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]
from	20	35	50	80	120
to	35	60	80	120	170
travel s	1,3	1,3	1,4	1,4	1,6
measuring depth MT	21	25	25	25	30
total length L	119	141	147	147	167
tube $\varnothing R$	8	12	12	12	18
centring plate width ZB	16	28	45	60	85
front distance h	9	10	15	15	18
number of measuring pins	8	6	7	9	5
number of increment washers	2	2	3	3	4
extensions	-	-	-	(1)/50	-



CITO 3P

SUBITO® with direct measuring axis SD

With large diameters (from 280 mm) the measuring value can be read directly in the bore because there is sufficient space. Protected in a housing, mechanical or digital dial gauges can be used to directly measure and indicate the bore diameter. The centring of the SUBITO® SD is made with the proven centring plate from the standard SUBITO®. The measuring instrument is adapted to the diameter to be measured with the standard measuring pins and extensions. Due to the 12 mm measuring travel, the nominal value to be measured does not have to be set directly, but any dimension within the measuring travel can be used.

Technical Data SD

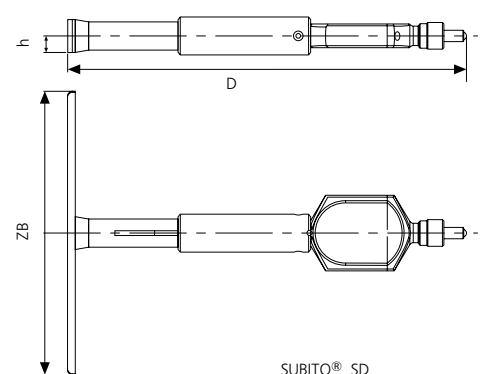
Measuring travel and accuracy are mainly defined by the dial gauge used.



SUBITO® SD

SELECTION CRITERIA FOR SUBITO® SD

Range of application	[mm]	[mm]
from	280	400
to	510	800
centring plate width	156	300
front distance h	16	17,5
number of measuring pins	7	11
number of increment washers	4	4
extensions	3	3



SUBITO® SD

SUBITO® setting device ESU

The ESU in connection with an existing gauge block set offers a reliable, flexible and economical calibration possibility for two-point contact comparator gauges of the series SU, SK and SW as well as for similar products of other manufacturers. The standard range of application is from 4,5 to 800 mm. For the SUBITO® blind bore measuring instruments of the series SS there are special setting jaws. The ESU is recommended when different diameters should often be calibrated. It can be used in horizontal or vertical position depending on the position in which the measuring instrument shall be used afterwards. The tube of the ESU is out of chemically nickel-plated steel, the measuring anvils are out of tungsten carbide. The remarkable feature of the ESU is its high precision:

- deviation of planeness of the carbide measuring anvils $\leq 0,6 \mu\text{m}$
- setting uncertainty (gauge block quality is not taken into consideration) $\leq 2 \mu\text{m}$

For the calibration the two measuring anvils are pressed against one gauge block or a gauge block combination; afterwards this unit is fixed in the groove of the ESU tube so that the measuring anvils stay connected tightly with the gauge blocks. Thus the contact force of the gauge to be calibrated is without influence on the accuracy.



SUBITO® setting device ESU



SUBITO® setting device ESU detail

SUBITO® for pillow block bores, grooves and recesses, ST

This measuring instrument has been developed especially for the determination of internal diameters where a smaller bore lying in front of this diameter has to be passed. Furthermore it serves for the measurement of grooves and undercuts, also in high measuring depths (up to 2000 mm). A measuring pin rotatable by 180° makes this possible. This pin is lying parallel to the centring plate during the passing of the small bore d1 and is rotated around a connecting link for the measurement of the larger diameter d2. The ST instruments are distinguished by a considerable retraction travel of up to 40 % of the diameter d2. The overall range of application is from 30 up to 530 mm for the diameter d2. Because of the subdivision of this range into seven instrument sizes a good centring in the bore to be measured and therefore a high measuring certainty is reached. The exact bore diameter is determined by oscillating the measuring instrument. The measuring principle of the ST instrument is based on the SUBITO® deviation which enables a high precision. The calibration of the instrument is effected with the fixed measuring pin swung out by means of a master setting ring or the setting device ESU with special setting jaws for the ST series.



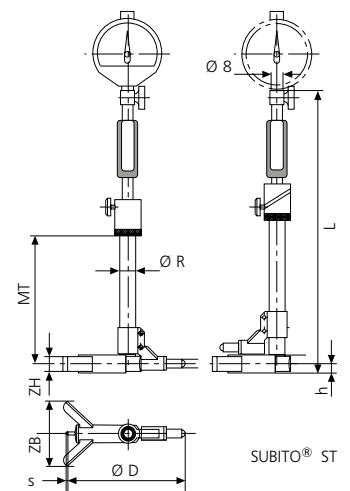
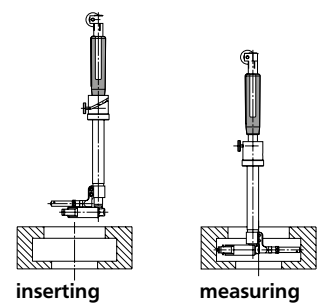
SUBITO® ST

Technical Data ST

range of application	30 - 220 mm	range of application	180 - 530 mm
repeatability	$f_w \leq 1 \mu\text{m}$	repeatability	$f_w \leq 1,5 \mu\text{m}$
max. deviation	$f_e \leq 2 \mu\text{m}$	max. deviation	$f_e \leq 3 \mu\text{m}$

SELECTION CRITERIA FOR SUBITO® ST

Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
from	30	50	60	80	120	180	290
to	52	70	100	150	220	360	530
travel s	1,3	1,3	1,4	1,4	1,4	1,6	2,6
measuring depth MT	60	60	109	109	109	148	170
total length L	194	201	264	264	265	343	409
tube $\varnothing R$	12	12	15	15	15	23	30
centr. plate width ZB	-	19,5	29,5	39	63	100	153
front distance h	4	5,25	7	7	8	11	15
centr. plate height ZH	-	6	8	8	10	10	10
no. of measuring pins	6	5	9	9	7	6	6
no. of incr. washers	2	3	3	3	3	4	4
extensions	12	-	-	(1)35	(2)35	(2)60	(3)60



SUBITO® ST

SUBITO® for grooves and recesses **SN**

The measuring instruments of the series SN serve also for the measurement of grooves and recesses. The retraction of the fixed measuring pin is here smaller than it could be achieved with the series ST, however it is possible to determine also small groove diameters. The base for this instrument is also the SUBITO®. The range of application is from 60 to 300 mm. The calibration of the instrument is affected with a master setting ring. If it is requested to measure a groove with an accuracy of only 1/100, the economical SCHWENK alternative for this is the series ON/ONM. To decide which measuring instrument is suitable for each situation, the following information is required:

- diameter d1 (inserting diameter),
- diameter D (diameter to be measured),
- groove width B,
- groove depth,
- measuring depth MT,
- accuracy tolerances

Technical Data SN

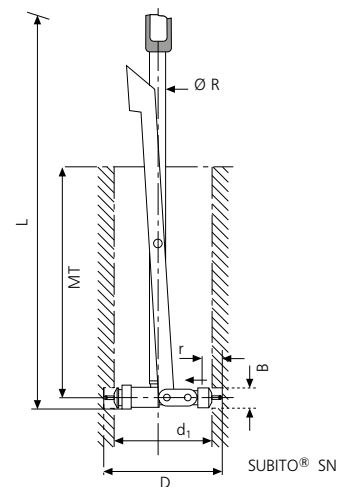
range of application	60 - 300 mm
repeatability	$f_w \leq 1,0 \mu\text{m}$
max. deviation	$f_e \leq 2,0 \mu\text{m}$

SELECTION CRITERIA FOR SUBITO® SN

Range of application D	[mm]	[mm]	[mm]
from	60	120	180
to	120	180	300
travel s	1,4	1,6	1,6
measuring depth MT	120	245	190
total length L	245	395	365
retraction travel r	8,5	23	30
tube $\varnothing R$	10	12	18
centring plate width ZB	28	50	120
front distance h	8	8	13
width of groove B	≥ 3	≥ 4	≥ 4



SUBITO® SN



SUBITO® to measure bores **SL** with boring bar

If there is an obstruction in the center of the bore to be measured, a standard measuring instrument cannot be used. This can occur e. g. when measuring on a machine and the boring bar cannot be removed for measuring. Within the application range the SL instrument can be adjusted freely by a column for the pre-adjustment. The measuring depth extends from 12 mm for the smallest gauge up to 30 mm for the largest gauge.

Technical Data SL

range of application	25 - 500 mm
repeatability	$f_w \leq 10 \mu\text{m}$

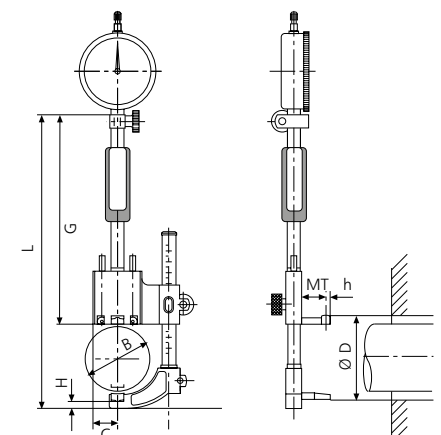
SELECTION CRITERIA FOR SUBITO® SL

Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]
from	25	35	100	100	200
to	70	105	210	280	500
travel s	2,0	3,0	3,5	3,5	3,5
measuring depth MT	12	17,5	30	30	30
front distance h	1,75	3,0	4,5	4,5	4,5
total length L min/max	190/235	212/285	293/403	293/473	620/730
max. boring bar $\varnothing B$	45	70	130	130	220
dimension C	17	23	37	37	62
dimension G	160	177	190	190	206
dimension H	7,7	6,5	10	10	10
minimal difference *	6	12	18	18	24

* between boring bar and bore wall



SUBITO® SL



SUBITO® SL

SUBITO® for internal profiles **KT**

The SUBITO® KT is used for the measurement of internal profiles, internal gear teeth, groove toothings and splined bore hub profiles. The SUBITO® segment deviation enables high reliability and accuracy. With the interchangeable KT measuring inserts an extensive range of application can be covered. The ball inserts are fitted with tungsten carbide balls and are screwed in the contact pin and the interchangeable measuring pins. The therefore used tungsten carbide balls are available from diameter 0,5 mm already; they are graduated by 0,001 mm and have a diameter tolerance of $\leq 2 \mu\text{m}$. If requested it is possible to make a calibration certificate for the KT ball inserts. During the oscillation process the instrument is centered automatically as the balls are guided prismatically in the profile to be measured. Master pieces or master setting rings are serving for the setting of those comparator gauges.

Accessories

- sets of ball inserts made of t/c (other materials on request)
- measuring depth extensions
- toothed setting rings

Technical Data KT

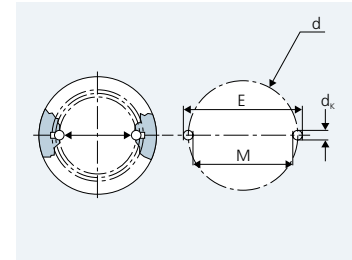
range of application	8 - 510 mm
repeatability	$f_w \leq 0,5 \mu\text{m}$
max. deviation	$f_e \leq 2 \mu\text{m}$

SELECTION CRITERIA FOR SUBITO® KT

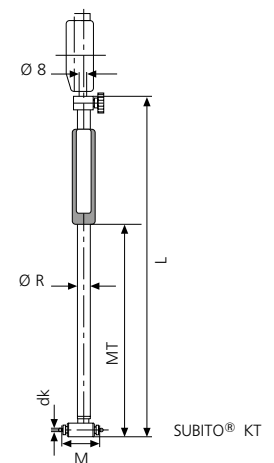
Range of application D	[mm]	[mm]	[mm]	[mm]	[mm]
from	8	12	22	55	100
to	12	22	55	250	510
travel s	0,6	0,6	1,0	1,5	1,5
measuring depth MT	100	102	115	177	235
total length L	165	168	204	290	363
tube $\varnothing R$	5	5	8	12	18
number of measuring pins	5	11	9	10	7
number of increment washers	1	1	2	3	4
extensions	-	-	(1)/16	(3)/50	(5)/70
thread ball insert	M 1,6	M 1,6	M 2,5	M 4	M 4



SUBITO® KT



Setting dimension for KT



SUBITO® for spherical bores **SUS**

The SUBITO® SUS serves for measuring of spherical diameters e. g. in differential housings in the range 14 to 320 mm. For the optimal and complete centring in spherical diameters from $\varnothing 28$, two centring units are required. The measuring instrument cannot be aligned or centered without the second centring unit.

Technical Data SUS

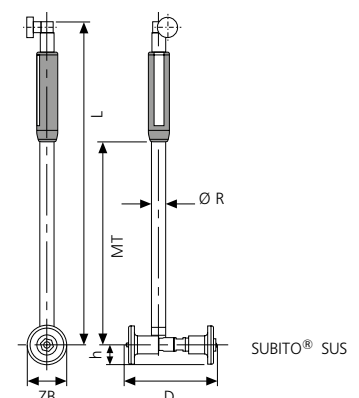
range of application	14 - 320 mm
repeatability	$f_w \leq 1 \mu\text{m}$
max. deviation	$f_e \leq 3 \mu\text{m}$

SELECTION CRITERIA FOR SUBITO® SUS

Range of application D	14-28	28-48	45-105	70-130	130-320
travel s	1,5	2	2,5	3	3
measuring depth MT	110	110	150	177	234
total length L	204	204	245	295	365
tube $\varnothing R$	8	8	10	12	18
front distance h	4	5,5	7,5	17	27,5
centring plate width ZB	8	11	14,8	34	55
number of measuring pins	15	5	4	6	4
extensions	-	1	2	1	2
number of increment washers	-	2	3	3	4



SUBITO® SUS





PMS BECUS
MÉTRÉLOGIE

546 avenue des Amaranches
ZAC Ecotec - F-74460 MARNAZ
Tél. 04 50 982 905 | info@pms-becus.com