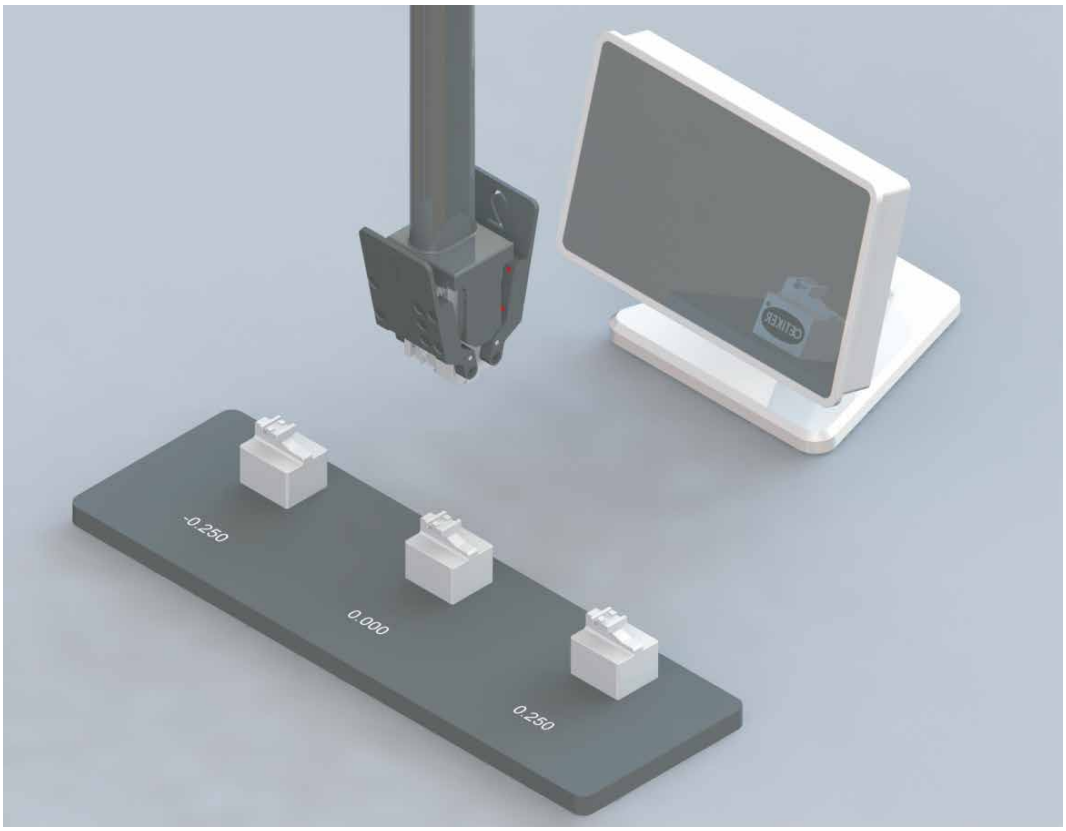


Measuring Equipment xVal 270

for WingGuard® Strap Clamp 270

Operating Instructions

Original instruction manual
Issue July 2022

Item no. 08904165
OETIKER Schweiz AG

Contents

1 Introduction

1.1 Validity

These Operating Instructions apply to the Measuring Equipment xVal 270 with display and gauge stand for Oetiker WingGuard® Strap Clamp 270.

1.2 Introduction

These Operating Instructions are part of the scope of supply. They must always be near the Measuring Equipment and accessible, and must be passed on to the new owner if the Measuring Equipment is sold. These Operating Instructions are not included in a revision service.

- Please follow the instructions given below.
- Read the Operating Instructions attentively before putting the Measuring Equipment xVal 270 item no. 13500244 into service.
- Ensure that you are thoroughly familiar with the whole equipment, features and their functions.

Service and repair work must only be carried out by Oetiker factories. Please contact your local Power Tool Center PTC. (www.oetiker.com)

The Measuring Equipment xVal 270 must only be used by people who have been instructed about the proper use and dangers associated with it. Inproper use or handling with the xVal 270 can lead to wrong measurements.

Spare parts
In case of service or malfunction, the Measuring Equipment xVal 270 has to be sent to Oetiker Power Tool Center (PTC) for maintenance. No spare parts are available.

1.3 Symbols and means of representation

Safety notices are used in this manual to warn of the risk of personal injury or property damage.

- ▶ Always read and follow these safety notices.
- ▶ Check all notices that are flagged with a safety alert symbol and text.

The following symbols are used in this instruction manual:

⚠ DANGER

Hazardous situation.
Failure to observe this notice will lead to death or serious injury.

⚠ WARNING

Hazardous situation.
Failure to observe this notice may lead to death or serious injury.

⚠ CAUTION

Hazardous situation.
Failure to observe this notice may lead to minor injury.

NOTICE

Information relating to the understanding or optimization of working practices.
Information indicating technical requirements for optimum performance and efficiency.

Symbol	Meaning
▶ ...	One-step instruction
1. ... 2. ... 3. ...	Multi-step instruction ▶ Carry out the steps in the order shown.
✓ ...	Requirement • Necessary or labor-saving steps for the successful execution of an action

1.4 Scope of supply

Part	Abbreviation	Part number / notes
Measuring Equipment with display, caliper and gauge stand	xVAL 270	13500244
Caliper Jaw Head		13500245
Gauge stand, docking station with gauge blocks		13500243
Display		13500247
Operating Instructions		08904165

1.5 General technical information

1.5.1 Set parts

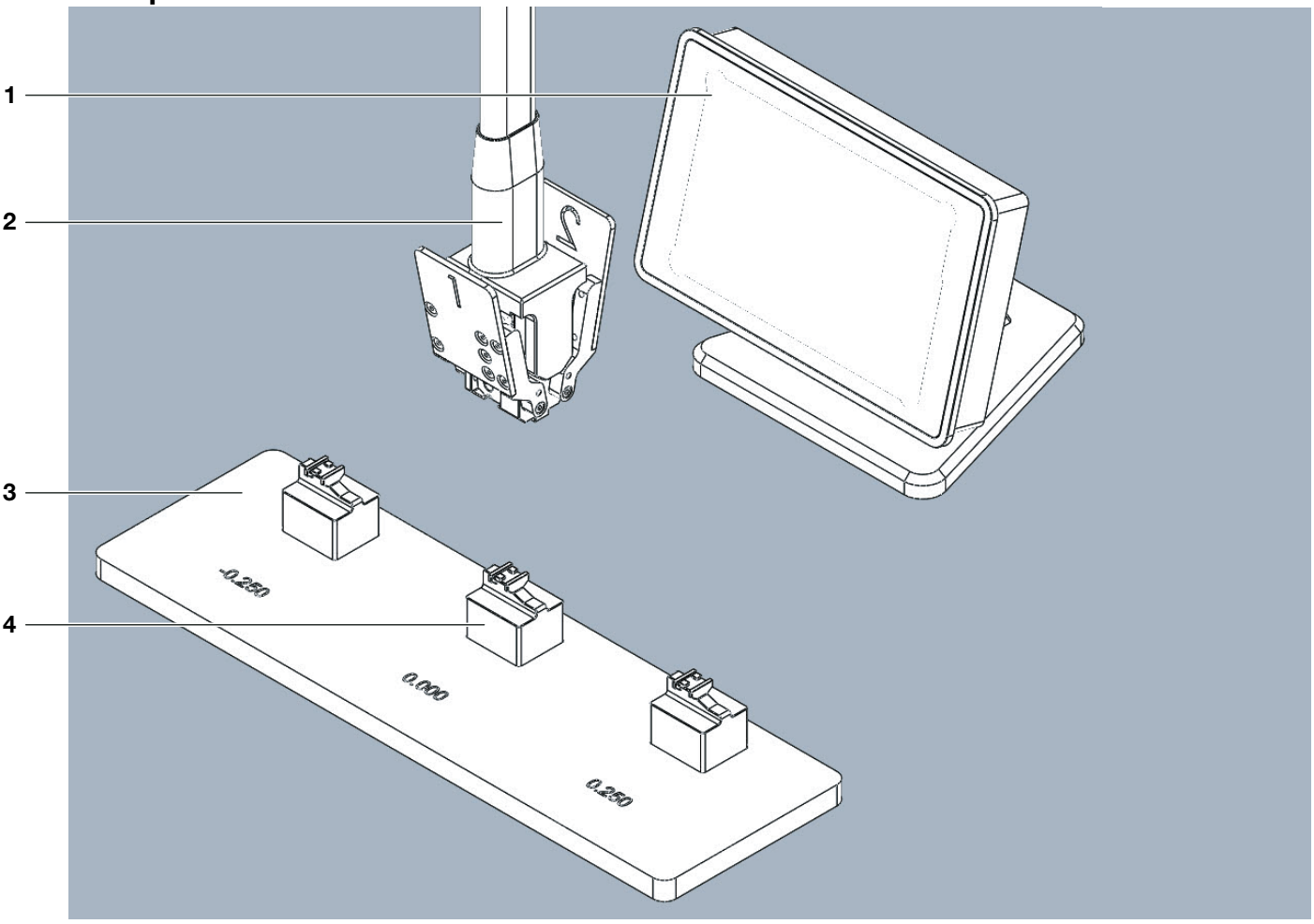


Fig. 1 Complete set

1 Display
2 Caliper Jaw Head
3 Gauge Stand
4 Gauge Blocks

1.5.2 Caliper Jaw Head part description

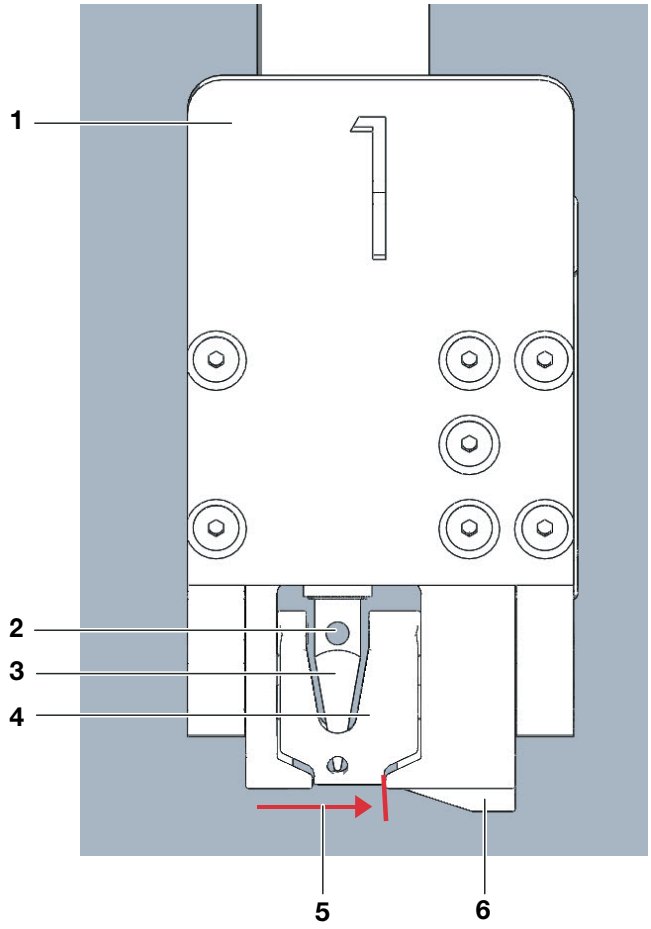


Fig. 2 Caliper detailed view, Front

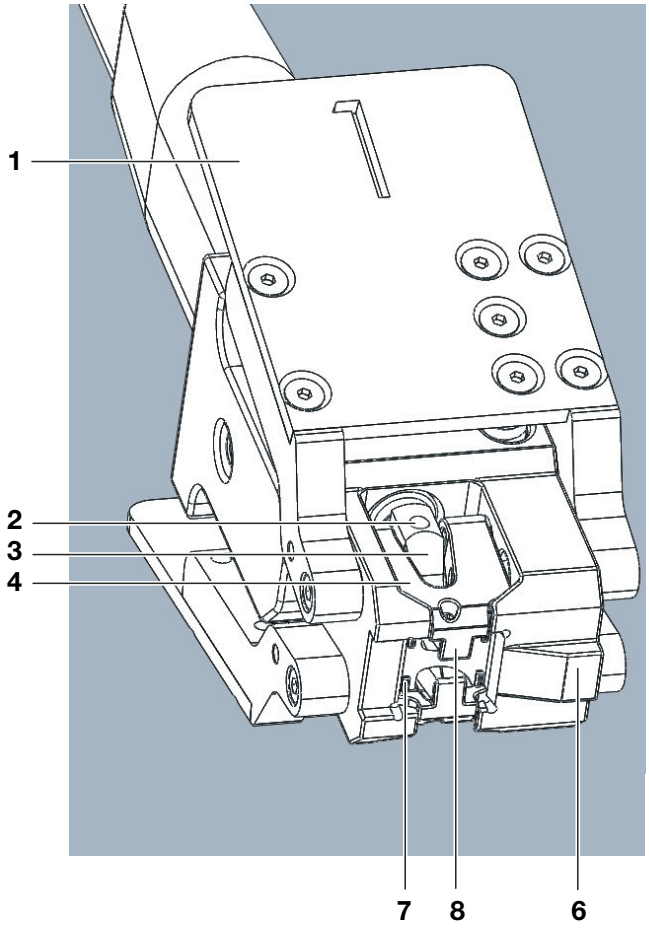


Fig. 3 Caliper detailed view, Bottom

1	Caliper jaw handle	5	Vertical reference plane
2	Alignment hole	6	Positioning wedge
3	Sensor measuring tip	7	Jaw wings (4x)
4	Caliper jaw	8	Horizontal reference plane tips (2x)

2 Safety Instructions

2.1 Safety Advice

To ensure safe operation, the measurement equipment must only be used in accordance with these Operating Instructions. In addition, when using it, the relevant legal and safety regulations must be observed. The operator of a plant, in which the xVal 270 is being used, is responsible for the safety of his employees; it is a part of his responsibility to implement measures to ensure that such regulations are observed, and to check on their execution.

▶ The plant operator must ensure that:

- the xVal 270 is only used for the intended purpose;
- a check is made before initial start-up to ensure that the specified operating voltage corresponds to that available where the machine is to be used, and that the supply circuit has adequate protective measures;
- the xVal 270 is only used when it is in perfect operating condition;
- the Operating Instructions are always kept available, complete and in readable condition near where the xVal 270 is being used;
- only personnel who are authorized and qualified for the task use the xVal 270;
- these persons are regularly instructed in relevant aspects of safety at work and environmental protection, and are familiar with the Operating Instructions and particularly with the safety instructions they contain;
- all personnel who are entrusted with the tasks of assembling, commissioning, maintaining or repairing the unit must have read and understood these Operating Instructions and specially the safety recommendations they contain;
- none of the safety and warning notices on the xVal 270 are removed, and that all are kept in a legible condition.

2.2 Proper Use

The xVal 270 is intended exclusively to verify that WingGuard® Strap Clamps 270 from Oetiker are locked properly and with closing wings positioned within the required range. For detailed information also consult the costumer drawing regarding WingGuard® Strap Clamps 270. Any use outside the scope of that description is considered as „improper use“.

„Improper use“ includes, for example:

- Depth measurements on clamps for which the xVal 270 is not approved and/or those that are not Oetiker products.

2.3 General dangers resulting from failure to observe safety instructions

The Measuring Equipment xVal 270 conforms to the 'state of the art' and is safe. The unit can nevertheless give rise to residual dangers if it is used by untrained personnel or for inappropriate tasks. For any injury or damage to persons or property that are caused by improper use, the operating authority is responsible, not the manufacturer of the Measuring Equipment xVal 270.

2.4 Safety-conscious operation

Fault messages must only be acknowledged when the cause of the fault has been corrected and there is no further danger.

- Before starting to use it, check the xVal 270 for visible damage and ensure that it is in perfect operating condition.
- Report any defects found to your supervisor immediately and stop using the Measuring Equipment xVal 270.

2.5 Changes and modifications

The Measuring Equipment xVal 270 must not be changed in any way affecting its construction or safety without written permission by Oetiker. Any change will have the effect of cancelling our liability for resultant damage. It is forbidden to carry out any extension of cables, changes to the cables, and repairs.

2.6 User qualification

This unit must only be used by qualified personnel and exclusively in accordance with the technical data and safety advice given in these Operating Instructions. In addition, while it is being used, the legal and safety regulations that are valid for this application must be observed.
Qualified people are people who are familiar with installation and operation of the measure equipment, and who have qualifications appropriate to their function.

2.7 Cleaning

- Use a soft cloth slightly soaked with an ethyl alcohol based product for cleaning. Do not use the following products: acetone, benzene, toluene and halogens hydrocarbons.

2.8 Inspection

- Perform zero setting procedure at least once per work-shift duration to ensure uniform and reproducible process quality.
- In case of service or malfunction sent the measuring equipment to Oetiker Power Tool Center (PTC) for maintenance. No spare parts are available.

3 Application

The xVal 270 consists of a hand held unit for:
Measuring the relative distance between the clamp housing top plane and both of each wing tips independently when the clamp is fully installed and locked with both wings bent up.
The measured values will be shown automatically as absolute lengths on the display, each wing with a separate value.

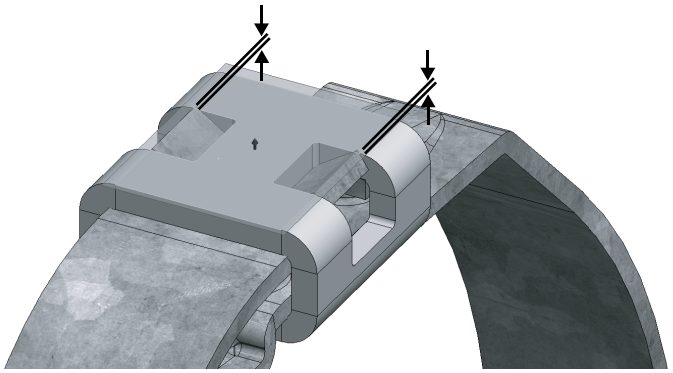


Fig. 4 Distance to measure (both sides)

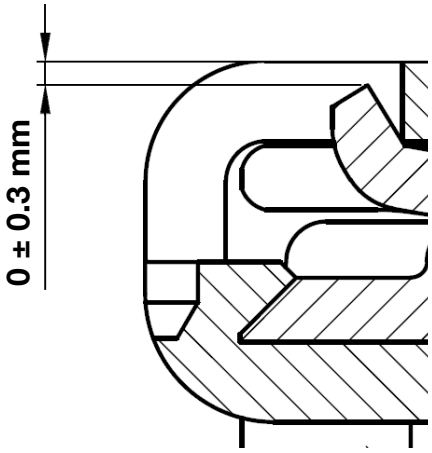


Fig. 5 Distance to measure (sectual drawing)

4 Display

The following explanations of the Metro M3 display are based to the original manufacturer manual.

NOTICE
Misuse due to non-observance of the original manufacturer manual! ▶ Read the complete original manufacturer manual before using the Metro M3 display.

4.1 Ports and Connections

RS232 communication port

The M3 is fitted with a RS232 port. It allows linking the M3 display to PC or an external system. The configuration is as follows: 9600 bauds, 8 bits, 1 stop bit, no parity.

Connector pinout (SUBD 9 pins female connector):

Pin	Signal	Direction	Description
1	–	–	Not used
2	RX	Input	Reception of data
3	TX	Output	Transfer of data
4	IN1	Input	Do not use. Only for firmware update
5	Gnd	–	Ground
6	–	–	Not used
7	IN2	Input	Do not use. Only for firmware update
8 and 9	–	–	Not used

Mini-USB connector

The mini-USB connector has 2 functions:

- Power supply through a wall mounted transformer. This transformer supplies a regulated 5 V/1 A DC voltage.
- Measurement transmission. If the M3 display is connected to a PC, the PC will detect and install automatically the M3 display as a standard USB keyboard with the standard drivers of the operating system (Windows, Mac OS etc...). When the measurement is send, the value will be written on the PC screen at current cursor position.

Fig. 6 Mini-USB connector

24VDC connector

It is advised to use this power supply when the M3 display is panel-mounted. Using this power supply instead of the mini-USB will deactivate the ON-OFF switch. Therefore, when the M3 display is powered, it will start automatically.

Fig. 7 24VDC connector

Footswitch connector

The footswitch connector is used to connect the Metro footswitch ref 18020 to the M3 display.

Fig. 8 Footswitch connector

The footswitch can then be used for the following functions:

- Transfering the measurement
- Presetting
- Starting a dynamic measurement
- Zeroing
- Changing the displayed part reference

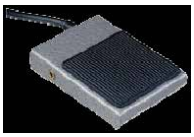


Fig. 9 Footswitch

4.2 Icon Desktop

The **Icon desktop** is the home screen and the starting point for all activities of the M3 display software. The different menues will be accessed by touching the icon.

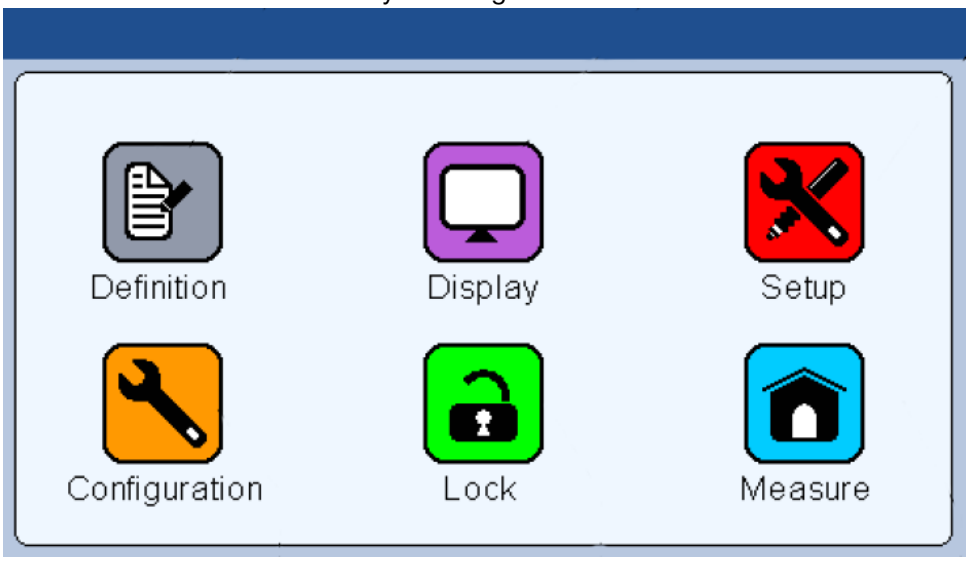


Fig. 10 **Icon desktop** home screen

The **Icon desktop** contains the following icons:

Icon	Description
Definition	Characteristic edition (tolerances, master part, formula)
Display	Display mode selection (1 or 2 bargraph, needle, without tolerance ...)
Setup	Adjustment of the probes and setting a probe coefficient
Configuration	Configuration of the device language, footswitch function etc.
Lock	Allows to lock selected functions by password
Measure	Go to the measuring screen

If one of the menu is displayed (e.g. **Measure**) the Icon desktop will be accessed again by touching the **Menu** button:

Fig. 11 **Menu** button

5 Equipment setup and zero setting

5.1 Preliminary instructions

The alignment pin must be carefully removed before using the equipment for the first time. This pin is needed for transportation purposes only, to keep the measuring tips aligned during transport.

1. Remove the alignment pin (1) by pulling it from its red portion and sliding it from the alignment hole located on the measuring tip of the measuring device .
2. Store the alignment pin for future transports (e.g. returns for maintenance).

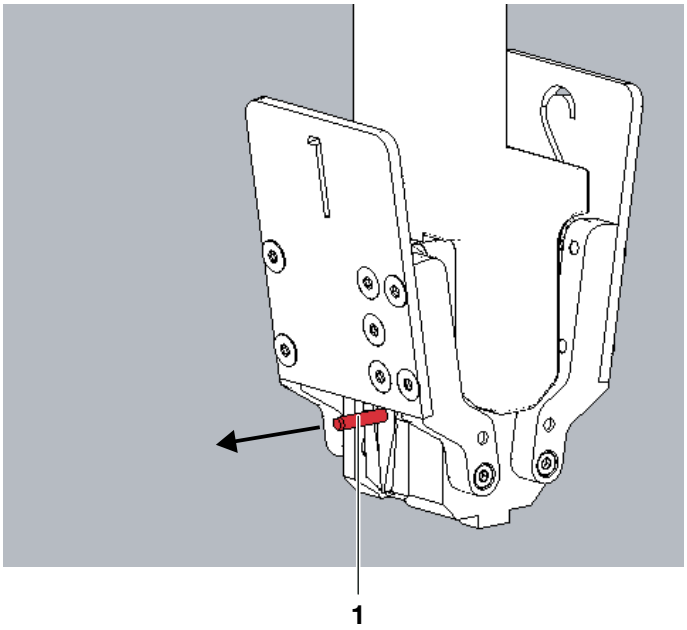


Fig. 12 Alignment pin removal

5.2 Equipment set up

1. Connect the caliper jaw head cable 1 to the display connector plug 1.
2. Connect the caliper jaw head cable 2 to the display connector plug 2.
3. Connect the display with the PC via USB cable (3) to power supply.

Fig. 13 Display connector sockets (rear view)

4. Push the on/off button (1) to turn on the display.

Fig. 14 Display On/Off switch (rear view)

5. Be aware, that the screen will display erratic readings. If not see „Footswitch connector“, page 4-13.

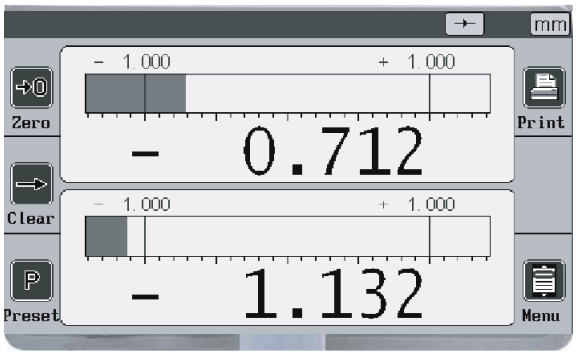


Fig. 15 Example Values (values may vary)

NOTICE

Further information of the M3 display (e.g. connection options or function) are described in original manufacturer manual of the display supplier attached to the delivery scope.

5.3 Zero setting procedure

The goal of the zero setting is to set the measurement equipment to its zero level.
Without setting the zero level correctly, the measurement will have a systematic bias to the standard.
For the zero setting, a standard zero level is needed. This is given by gauge block 0.000.
The zero setting is part of the adjusting.

NOTICE

Failure due to wrong setting procedure!

- Perform zero setting procedure at least once per work-shift duration to ensure uniform and reproducible process quality.
- Do not touch the instrument when zero setting / measuring.

The engraved values **-0.2XX** and **+0.2XX** are values coming from the attached measurement report. The values may differ from xVal to xVal.

1. Hand hold the caliper jaw head, pressing the handles in arrow direction to open the jaws and keep position.

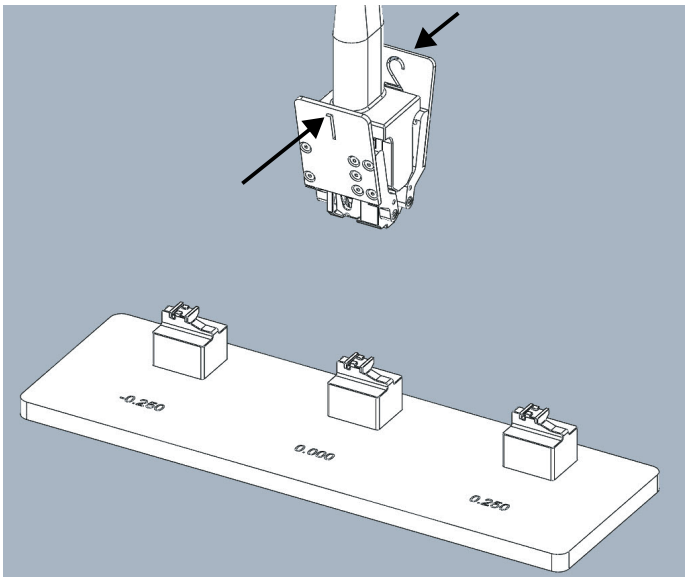


Fig. 16 Starting zero setting

2. To get a proper positioning of the caliper, ensure the following conditions:
– The wedges from the caliper jaw head (2) and the gauge block (1) are on the same side and the tilted faces are parallel (red section).
– The horizontal reference plane tips are in contact with the upper surface of the gauge.

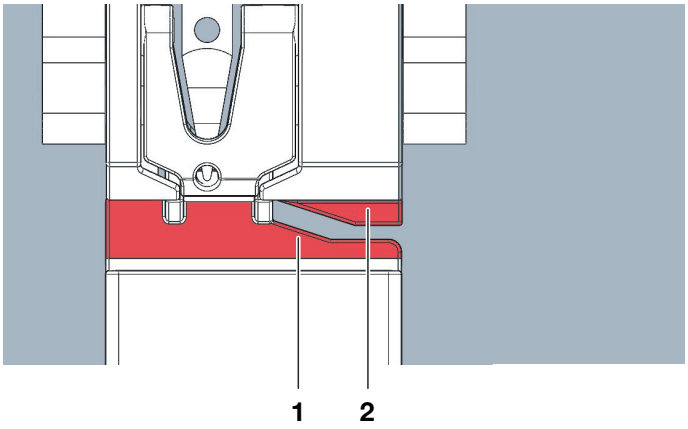


Fig. 17 Proper wedge alignment

3. Release the handles and dock the xVal 270 onto the **0.000** gauge block.
4. Take your hands off the caliper jaw head while executing the zero setting procedure. Otherwise values can be lightly affected.

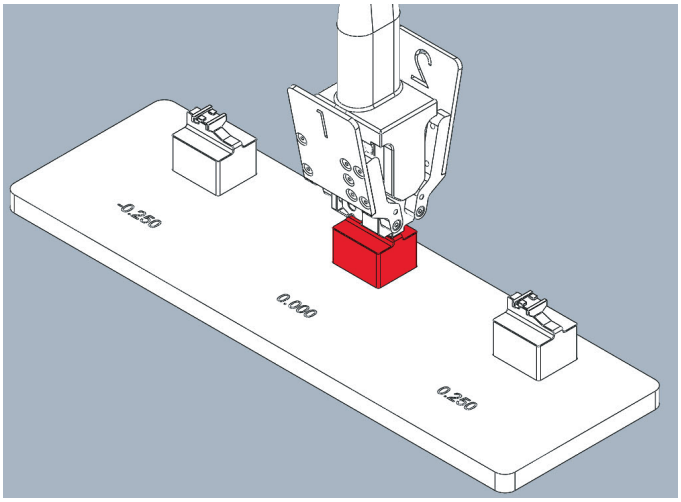


Fig. 18 Zero position to zero gauge

5. Click the button **Zero** on the screen when the measuring caliper jaw head is properly placed on the gauge block.
↳ The dialogue box **Select channel** will open to select a channel.
6. Select channel **1** on the dialogue box.
7. Click the button **Zero** on the screen.

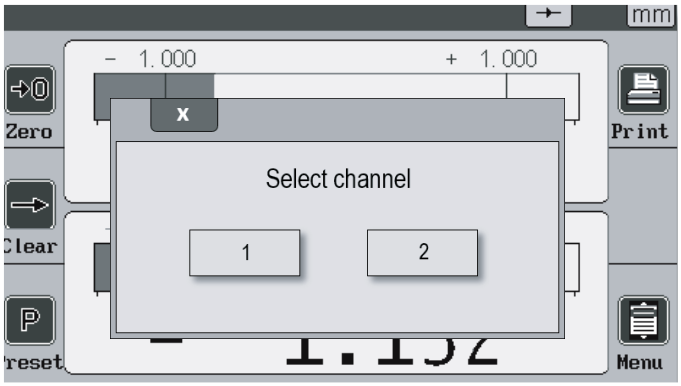


Fig. 19 Display dialog box

8. Make sure that the screen shows **0.000 ±0.005** as reading for channel **1**. If the reading is out of the tolerance range, proceed with step 16.
9. Repeat steps 5 to 8, but now selecting channel **2** and make sure that the screen shows **0.000 ±0.005** as readings for both channels.
10. Press the handles and remove the caliper.

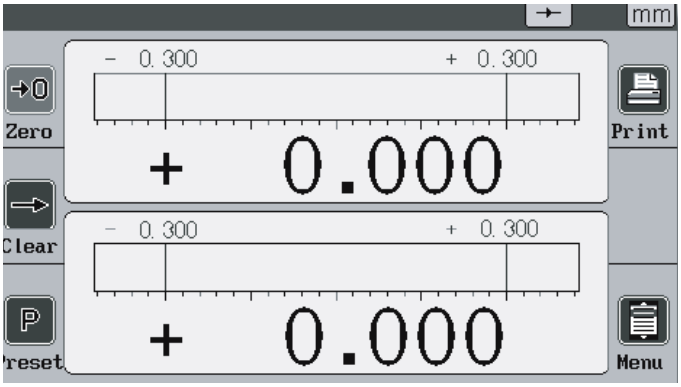


Fig. 20 Values zeroed

Calibration procedure

11. Place the caliber on the control gauge block **-0.2XX**.

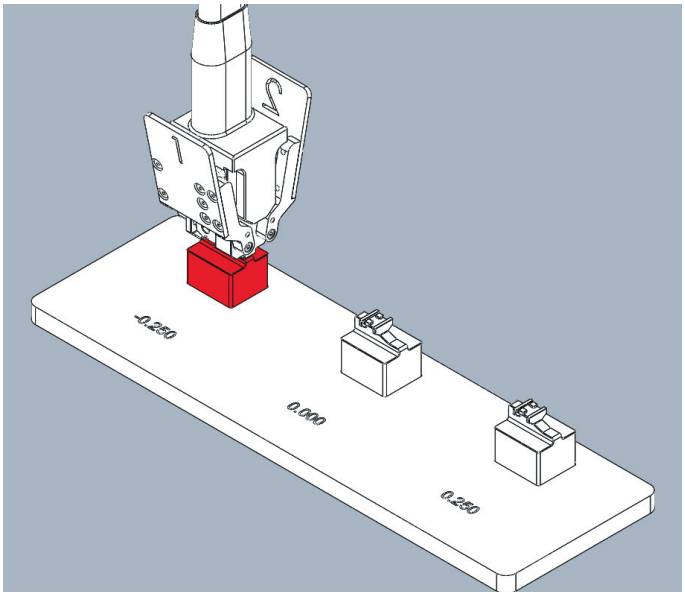


Fig. 21 Position for -0.2XX control gauge (example)

12. Make sure that the readings displayed on channel **1** and **2** do not exceed the tolerance of ±0.010 to the engraved value on the Gauge stand. If the reading is out of the tolerance range, proceed with step 16.
13. Press the handles and remove the caliper.

Fig. 22 Negative example values (values may vary)

14. Place the caliber on the control gauge block **+0.2XX**.

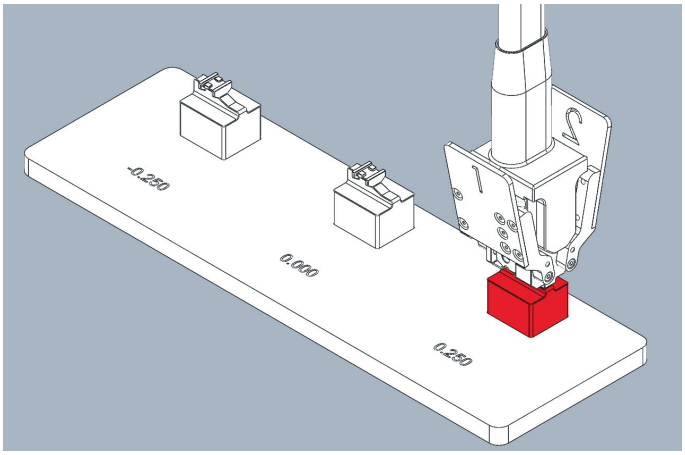


Fig. 23 Position for control gauge +0.2XX (example)

15. Make sure that the readings displayed on channel **1** and **2** do not exceed the tolerance of ±0.010 to the engraved value on the Gauge stand. If the reading is out of the tolerance range, proceed with step 16.

↳ The Measuring Equipment xVal 270 is zeroed and ready to use.

16. If one of the values is out of the tolerance range, repeat the whole zero setting procedure. If the values are still out of the tolerance range, contact Oetiker PTC for checking the xVal 270 (www.oetiker.com).

Fig. 24 Positive example values (values may vary)

6 Measuring the relative position (wing height) of the clamp wing tips

✓ The measuring equipment is zeroed and ready for use.

1. Place the caliper position wedge (1) opposite to the clamp overlap (2).

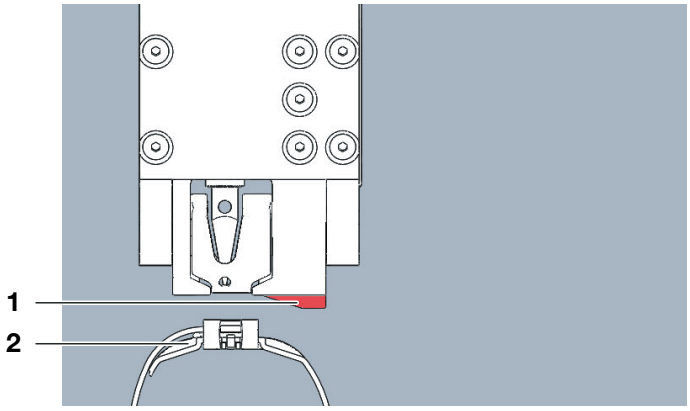


Fig. 25 Caliper Jaw Head in position to take measurements

2. Press caliper jaw handles to open the jaws and place the Wings at the notches located at both sides of the Clamp housing.
3. Release the caliper. Make sure to not touch the caliper when executing the measurement.

↳ The values are shown on the display.

4. Compare the two values on the display with the Oetiker PG 270 customer drawing no. 151.006.397.
5. Make sure that the two values must lie within the given tolerance range. If not, repeat your supervision again. If the values are still outside the given tolerance on the customer drawing no. 151.006.397 the wings are not properly closed. Do not use the application.

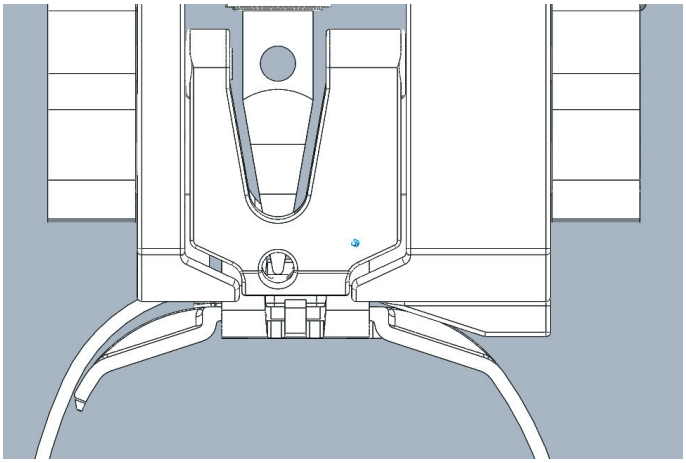


Fig. 26 Caliper Jaw Head attached with the clamp

7 xVal capability

The measurement equipment capability of the xVal System refer to the delivery condition with the provided original auxiliary equipment and a proper zero setting on the delivered gauge stand (0.000 gauge block). The capability has been done with a Measurement System Analysys Type 1 (MSA 1) according to VDA 5 and ISO 22514-7. The certification of the MSA 1 is part of the delivery condition and can be found into the document holder of the transportation case.

Nominal measurement area:	0.000 mm ± 0.500 mm
Resolution:	0.001 mm
Tolerance:	± 0.02 mm
Measurement Capability Index C_g:	> 1.67
Measurement Capability Index C_{gk}:	> 1.67

The MSA Type 2 to has to done in the real process. Oetiker cannot provide any MSA 2 certification.
Oetiker recommend a calibration and zero setting of the xVal System once a work-shift duration according the section 5 in this manual.

8 Calibration

8.1 Definition of calibration, zero setting and adjusting

8.1.1 Calibration

The goal of a calibration is to trace a bias or error of a measurement equipment (compare to a standard). The calibration occurs without any intervention to the measurement equipment. The calibration should be performed from a qualified person and shows a snap-reading method. If needed such calibration could be done from accredited lab but has also be performed by a qualified user.
Oetiker recommend as a calibration an MSA 1* study for the hole xVal measurement system. An MSA 1 study delivers beside a calibration also a statistical capability study. Every xVal is proven with an MSA 1 study and capable according to chapter 7.

8.1.2 Zero Setting

The procedure is described in chapter 5.3.

8.1.3 Adjusting

The goal of the adjusting is aligning a measurement equipment to an acceptable systematic error of their system. In other words, after the zero setting, the system must know the slope (also named as sensitivity or correlation).
The adjusting of the xVal, except the zero setting, has to be done over Oetiker Schweiz AG and should never change during its life time.

8.2 Interval of calibration

It is recommended to recalibrate the hole measurement equipment xVal once a Year. This recommendation is based on a normal use, means used in a proper production area for a 100% product check of the wing height of the PG 270 clamp. If the yearly production volume overruns 500’000 parts, Oetiker recommends an adaptation of the recalibration frequency accordingly. Please take care that the calibration includes the hole xVal system, see as well following chapter for the calibration of the single parts or the xVal system.
Beside the official calibration of the xVal measurement system, a normal daily verification is recommended. This verification should be done once a shift. The procedure is the same but will be done without any protocol and could be done from every person. The daily verification reduces the risk for a wrong measurement. The procedure is described in chapter 5.

8.2.1 Gauge Stand with Gauge Blocks

The xVal Gauge Stand consists of three gauge blocks and a base plate. The 0.000 gauge block is used to make the Zero setting, to trace an error or to perform a MSA 1 study. The other two gauge blocks, +0.XX0 and -0.YY0 are used to trace an error or perform a MSA 1 study as well. The gauge blocks are the standards of the xVal measurements system. The blocks are like standard slip gauges and should be handled as them.
The xVal gauge blocks are delivered with a measurement report performed by Oetiker Schweiz AG (a non accredited lab). With the recommended calibration of the whole xVal measurement system a recalibration of the gauge blocks it self is also mandatory. This calibration of the gauge blocks could be done from qualified person working in a measurement lab or if needed from an accredited lab. See chapter 8.5.

8.2.2 Display with Caliper Jaw Head

The xVal display with Caliper Jaw Head consists the display with its amplifier and control system and the jaw head with its two stroke measurement sensors and the body to fit the Oetiker PG270 strap clamp. The touch panel allows all settings and is showing the measurement result of the two sensors. The jaw head is designed to measurement the Wing Height of all Oetiker PG 270 clamp. With its special designed lock system, almost no human influence has a negative influence on the capability of the whole xVal measurement system.
With the recommended calibration of the whole xVal measurement system, an adjusting of the display is not necessary. The sensitivity of the two measurement sensors is saved and the display does not underlie any wear or other influences. It should never change over the lifetime.

8.3 Required calibration material and qualified personnel

8.3.1 Calibration material

- USB power supply
- xVal measure equipment with base plate and caliper jaw head
- These operating instructions
- Standard height gauge equipment with a measurement uncertainty of < 0.002mm

8.3.2 Qualified personnel

To do a proper calibration of a measurement equipment, some basic knowledge is required. Oetiker recommend a qualified person that is familiar with measurement equipment like caliper, height gauges and measurements report and has a high quality understanding and feeling. Knowledge in the area of an MSA 1 study according ISO 22514-7 or VDA 5 is needed.

8.4 Environmental condition

A calibration should be done in a measurement lab (Quality department) with 20° Celsius and 50 % humidity and with a proper environmental.

8.5 Procedure options

The procedure written into this document is a simplified procedure. There are different calibration procedures possible:

- By directly an accredited lab
- By Oetiker PTC over an accredited lab

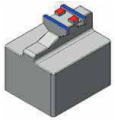
Oetiker does not recommend any specific option. But if the calibration is done over an accredited lab, it must be carried out according the “VDI/VDE/DGQ 2618 Part 3.1, Test instruction for gauge blocks”, or similar.
As already explained the written procedure in this document is a simplified procedure and contains only the most important steps, because the xVal gauge blocks are not exactly like standard slip gauges.
The same is for the calibration of the hole system. As well here Oetiker recommend doing this in an MSA 1 study according to ISO 22514-7 or VDA 5.

8.5.1 Option 1, by directly over an accredited lab

It is allowed to handle the calibration of the gauge block and the xVal measurement system internally over an official and accredited lab. The procedure is the same, but he will get a certified calibration report. Oetiker recommend this option together with the considering of the standard VDI/VDE/DGQ 2618 Part 3.1, Test instruction for gauge blocks.

Gauge Blocks

- For details please see VDI/VDE/DGQ 2618 Part 3.1.
- Disassemble the three gauge blocks from the base plate.
- Clean them with a soft cloth slightly soaked with an ethyl alcohol-based product.
- Use a standard height gauges equipment with a measurement uncertainty of < 0.002mm.
- Measure each gauge block (+X.XX0, -0.YY0, 0.000) according following steps:
  1a. Check the flatness of the two red areas, they should be into 0.01mm.
  1b. Check the flatness of the two blue areas, they should be into 0.01mm.
  2. Zero the measure equipment onto the two red bases.
  3. Measure from each red colored area to each of the two blue colored areas.
  4. Check the results of this 4 measurements whether each dimension is within a tolerance of ±0.005 mm of the marked height +X.XX0, -0.YY0 or 0.000.



- Repeat this procedure for every gauge block (+X.XX0, -0.YY0, 0.000).

- If the gauge blocks are out of the specification, they are worn out and must be exchanged by Oetiker. Please send them back to the local PTC (including the base plate).
- If the gauge blocks are in the specification assemble the three gauge block according the marked dimension to the base plate. Take care they are mounted parallel to each other.

xVal measurement sytem

There are two recommended calibration possibilities for the complete xVal measurement equipment.
Either annual calibration or annual MSA 1 study.
Annual calibration: This must be carried out the same way as daily verification and includes additional a proper documentation. The verification has to be performed by a qualified person.
Please follow the following steps:

- Place the caliper jaw head onto the 0.000 Gauge Block.
- Check if the values on the display are within a tolerance of 0.005 mm.
- If the values are out of the tolerance, proceed with Zero Setting as described in chapter 5.3.
- Place the caliper jaw head onto one of the gauge block (+0.XX0 or -0.YY0).
- Check if the values on the display are within the tolerance of ±0.02 from the marked value.
- If the values are not within the tolerance, repeat Zero Setting as described in chapter 5.3.
- If the values are still out of tolerance, the system must be sent back to the local PTC (including the base plate).

Annual MSA 1 study: The MSA 1 study is much more accurate than a simple calibration. It gives more than just a measurement error from a measurement system. With an MSA 1 study the user gets a clear statistical feedback if the measurement system is capable for the measurement job. Oetiker recommend to do the MSA 1 study according ISO 22514-7 or VDA 5. There are some form sheets and a higher knowledge necessary to do such an MSA 1 study.
The MSA 1 study is performed with the following parameters and has to fulfil them:
Cgk > 1.67, Tolerance = ±0.03, according ISO 22514-7 or VDA 5.

8.5.2 Option 2, by Oetiker PTC over an accredited lab

If the customer has detailed specifications or requirements into the company handbook, but not able to handle it directly over an accredited lab, he can send the complete xVal measurement equipment to a local Oetiker PTC. The PTC will organize the calibration over an official and accredited lab. The accredited lab will make the calibration with an official accredited measurement report according VDI/VDE/DGQ 2618 Part 3.1, Test instruction for gauge blocks.

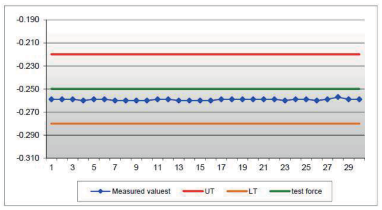
Measurement System Analysis Typ 1: C_g / C_{gk} — Oetiker Schweiz AG

Test Equipment:	Measuring Equipment xVal 270 (13500244) / SN 010045967-0024		
Laboratory:	Assembly department	Test Date:	23.08.2019
U Kal:	0.005 [mm]	Name of Appraiser	D. Fernes
Resolution:	0.001 [mm]	Test Department:	Power Tool

Test Dimension -0.250 mm

Measure no.	Test Dim. [mm]
1	-0.259
2	-0.259
3	-0.259
4	-0.260
5	-0.259
6	-0.259
7	-0.260
8	-0.260
9	-0.260
10	-0.260
11	-0.259
12	-0.259
13	-0.260
14	-0.260
15	-0.260
16	-0.260
17	-0.259
18	-0.259
19	-0.259
20	-0.259
21	-0.259
22	-0.259
23	-0.260
24	-0.259
25	-0.259
26	-0.260
27	-0.259
28	-0.257
29	-0.259
30	-0.259

Upper Tolerance UT:	-0.220	[mm]
Lower Toleranz LT:	-0.280	[mm]
C_{gk} ≥:	1.67	-
C_g ≥:	1.67	-
Sensor Part Nr. & Serial Nr.:	1T0517 615	
Amplifier Nr. & Serial Nr.:	M31716087	
Test Dimension Max.:	-0.257	[mm]
Test Dimension Average:	-0.259	[mm]
Test Dimension Min.:	-0.260	[mm]
Bias	-0.009	[mm]
Standard Deviation S:	0.001	[mm]
total Tolerance:	0.060	[mm]
$C_{g\,top}=\frac{OT-MW}{3s}$:	20.46	-
$C_{g\,down}=\frac{MW-UT}{3s}$:	10.78	-
$C_g=\frac{OT-UT}{6s}$:	**15.62**	-
C_{gk}:	**10.78**	-
Resolution in % of total Tolerance:	1.67	[%]
Calibration Uncertainty:	0.006	[mm]



Resolution: ≤ 5% T_{tot}	Calibration uncertainty: ≤ 10% T_{tot}	Capability C_g: ≥ 1.33	Capability C_{gk}: ≥ 1.33
adequate	adequate	capable	capable

Company Stamp: Oetiker Schweiz AG, Spätzstrasse 11, Postfach 358, CH-8810 Horgen, Tel. 044 728 55 55 Fax 044 728 55 15

Date & Signature: 23.08.2019

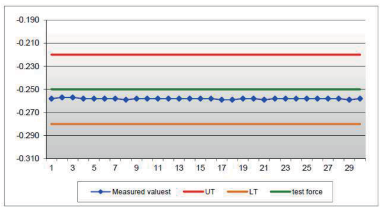
Measurement System Analysis Typ 1: C_g / C_{gk} — Oetiker Schweiz AG

Test Equipment:	Measuring Equipment xVal 270 (13500244) / SN 010045967-0024		
Laboratory:	Assembly department	Test Date:	23.08.2019
U Kal:	0.005 [mm]	Name of Appraiser	D. Fernes
Resolution:	0.001 [mm]	Test Department:	Power Tool

Test Dimension -0.250 mm

Measure no.	Test Dim. [mm]
1	-0.258
2	-0.257
3	-0.257
4	-0.258
5	-0.258
6	-0.258
7	-0.258
8	-0.259
9	-0.258
10	-0.258
11	-0.258
12	-0.258
13	-0.258
14	-0.258
15	-0.258
16	-0.258
17	-0.259
18	-0.259
19	-0.258
20	-0.258
21	-0.259
22	-0.258
23	-0.258
24	-0.258
25	-0.258
26	-0.258
27	-0.258
28	-0.258
29	-0.259
30	-0.258

Upper Tolerance UT:	-0.220	[mm]
Lower Toleranz LT:	-0.280	[mm]
C_{gk} ≥:	1.67	-
C_g ≥:	1.67	-
Sensor Part Nr. & Serial Nr.:	1T0517 603	
Amplifier Nr. & Serial Nr.:	M31716087	
Test Dimension Max.:	-0.257	[mm]
Test Dimension Average:	-0.258	[mm]
Test Dimension Min.:	-0.259	[mm]
Bias	-0.008	[mm]
Standard Deviation S:	0.000	[mm]
total Tolerance:	0.060	[mm]
$C_{g\,top}=\frac{OT-MW}{3s}$:	26.87	-
$C_{g\,down}=\frac{MW-UT}{3s}$:	15.45	-
$C_g=\frac{OT-UT}{6s}$:	**21.16**	-
C_{gk}:	**15.45**	-
Resolution in % of total Tolerance:	1.67	[%]
Calibration Uncertainty:	0.006	[mm]



Resolution: ≤ 5% T_{tot}	Calibration uncertainty: ≤ 10% T_{tot}	Capability C_g: ≥ 1.33	Capability C_{gk}: ≥ 1.33
adequate	adequate	capable	capable

Company Stamp: Oetiker Schweiz AG, Spätzstrasse 11, Postfach 358, CH-8810 Horgen, Tel. 044 728 55 55 Fax 044 728 55 15

Date & Signature: 23.08.2019

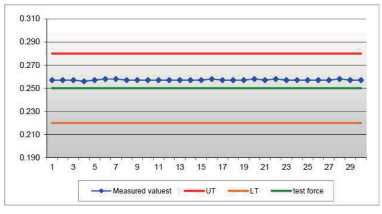
Measurement System Analysis Typ 1: C_g / C_{gk} — Oetiker Schweiz AG

Test Equipment:	Measuring Equipment xVal 270 (13500244) / SN 010045967-0024		
Laboratory:	Assembly department	Test Date:	23.08.2019
U Kal:	0.005 [mm]	Name of Appraiser	D. Fernes
Resolution:	0.001 [mm]	Test Department:	Power Tool

Test Dimension 0.250 mm

Measure no.	Test Dim. [mm]
1	0.257
2	0.257
3	0.257
4	0.256
5	0.257
6	0.258
7	0.258
8	0.257
9	0.257
10	0.257
11	0.257
12	0.257
13	0.257
14	0.257
15	0.257
16	0.258
17	0.257
18	0.257
19	0.257
20	0.258
21	0.257
22	0.258
23	0.257
24	0.257
25	0.257
26	0.257
27	0.257
28	0.258
29	0.257
30	0.257

Upper Tolerance UT:	0.280	[mm]
Lower Toleranz LT:	0.220	[mm]
C_{gk} ≥:	1.67	-
C_g ≥:	1.67	-
Sensor Part Nr. & Serial Nr.:	1T0517 615	
Amplifier Nr. & Serial Nr.:	M31716087	
Test Dimension Max.:	0.258	[mm]
Test Dimension Average:	0.257	[mm]
Test Dimension Min.:	0.256	[mm]
Bias	0.007	[mm]
Standard Deviation S:	0.000	[mm]
total Tolerance:	0.060	[mm]
$C_{g\,top}=\frac{OT-MW}{3s}$:	16.79	-
$C_{g\,down}=\frac{MW-UT}{3s}$:	27.33	-
$C_g=\frac{OT-UT}{6s}$:	**22.06**	-
C_{gk}:	**16.79**	-
Resolution in % of total Tolerance:	1.67	[%]
Calibration Uncertainty:	0.006	[mm]



Resolution: ≤ 5% T_{tot}	Calibration uncertainty: ≤ 10% T_{tot}	Capability C_g: ≥ 1.33	Capability C_{gk}: ≥ 1.33
adequate	adequate	capable	capable

Company Stamp: Oetiker Schweiz AG, Spätzstrasse 11, Postfach 358, CH-8810 Horgen, Tel. 044 728 55 55 Fax 044 728 55 15

Date & Signature: 23.08.2019

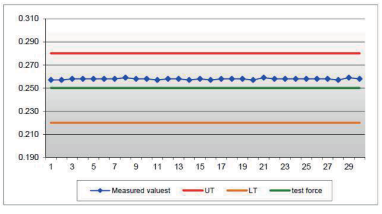
Measurement System Analysis Typ 1: C_g / C_{gk} — Oetiker Schweiz AG

Test Equipment:	Measuring Equipment xVal 270 (13500244) / SN 010045967-0024		
Laboratory:	Assembly department	Test Date:	23.08.2019
U Kal:	0.005 [mm]	Name of Appraiser	D. Fernes
Resolution:	0.001 [mm]	Test Department:	Power Tool

Test Dimension 0.250 mm

Measure no.	Test Dim. [mm]
1	0.257
2	0.257
3	0.258
4	0.258
5	0.258
6	0.258
7	0.258
8	0.259
9	0.258
10	0.258
11	0.257
12	0.258
13	0.258
14	0.257
15	0.258
16	0.257
17	0.258
18	0.258
19	0.258
20	0.257
21	0.259
22	0.258
23	0.258
24	0.258
25	0.258
26	0.258
27	0.258
28	0.257
29	0.259
30	0.258

Upper Tolerance UT:	0.280	[mm]
Lower Toleranz LT:	0.220	[mm]
C_{gk} ≥:	1.67	-
C_g ≥:	1.67	-
Sensor Part Nr. & Serial Nr.:	1T0517 603	
Amplifier Nr. & Serial Nr.:	M31716087	
Test Dimension Max.:	0.259	[mm]
Test Dimension Average:	0.258	[mm]
Test Dimension Min.:	0.257	[mm]
Bias	0.008	[mm]
Standard Deviation S:	0.001	[mm]
total Tolerance:	0.060	[mm]
$C_{g\,top}=\frac{OT-MW}{3s}$:	13.13	-
$C_{g\,down}=\frac{MW-UT}{3s}$:	22.47	-
$C_g=\frac{OT-UT}{6s}$:	**17.80**	-
C_{gk}:	**13.13**	-
Resolution in % of total Tolerance:	1.67	[%]
Calibration Uncertainty:	0.006	[mm]



Resolution: ≤ 5% T_{tot}	Calibration uncertainty: ≤ 10% T_{tot}	Capability C_g: ≥ 1.33	Capability C_{gk}: ≥ 1.33
adequate	adequate	capable	capable

Company Stamp: Oetiker Schweiz AG, Spätzstrasse 11, Postfach 358, CH-8810 Horgen, Tel. 044 728 55 55 Fax 044 728 55 15

Date & Signature: 23.08.2019

9 Help and Support

If you need help or technical support, contact the appropriate Oetiker service center.

See www.oetiker.com for further information.

EMEA	
E-Mail	ptsc.hoe@oetiker.com
Phone	+49 7642 6 84 0

Americas	
E-Mail	ptsc.oea@oetiker.com
Phone	+1 989 635 3621

China	
E-Mail	ptsc.cn.tianjin@oetiker.com
Phone	+86 22 2697 1183

Japan	
E-Mail	ptsc.jp.yokohama@oetiker.com
Phone	+81 45 949 3151

Republic of Korea	
E-Mail	ptsc.kr.seoul@oetiker.com
Phone	+82 2 2108 1239

India	
E-Mail	ptsc.in.mumbai@oetiker.com
Phone	+91 9600526454