Thicknäs and Width Gauge
for
Narrow Strip and Profile

VBK 593

Operating- & Service Instructions
## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Precautions, please read carefully!</td>
<td>3</td>
</tr>
<tr>
<td>Intended use of this machine</td>
<td>3</td>
</tr>
<tr>
<td>Spares</td>
<td>3</td>
</tr>
<tr>
<td>Design and Function</td>
<td></td>
</tr>
<tr>
<td>Thickness measurement by the standard version</td>
<td>4</td>
</tr>
<tr>
<td>Thickness measurement by adjustable C-frame</td>
<td>5</td>
</tr>
<tr>
<td>Width Measurement</td>
<td>5</td>
</tr>
<tr>
<td>System</td>
<td></td>
</tr>
<tr>
<td>Nominal size setting</td>
<td>7</td>
</tr>
<tr>
<td>Types</td>
<td>9</td>
</tr>
<tr>
<td>Measurement head adjustment</td>
<td>10</td>
</tr>
<tr>
<td>Installation</td>
<td>10</td>
</tr>
<tr>
<td>Levelling</td>
<td>11</td>
</tr>
<tr>
<td>Passline height</td>
<td>11</td>
</tr>
<tr>
<td>Measurement depth of the thickness frame</td>
<td>11</td>
</tr>
<tr>
<td>90° position and measurement frame spring load</td>
<td>12</td>
</tr>
<tr>
<td>Upper guide rollers</td>
<td>13</td>
</tr>
<tr>
<td>Width measurement frame height</td>
<td>13</td>
</tr>
<tr>
<td>Measurement</td>
<td>14</td>
</tr>
<tr>
<td>Zero check</td>
<td>14</td>
</tr>
<tr>
<td>Nominal size and tolerance limits</td>
<td>14</td>
</tr>
<tr>
<td>Measurement start and end</td>
<td>14</td>
</tr>
<tr>
<td>Important note:</td>
<td>15</td>
</tr>
<tr>
<td>Continuous check</td>
<td>15</td>
</tr>
<tr>
<td>Safety precautions</td>
<td>16</td>
</tr>
<tr>
<td>Strip breaking</td>
<td>16</td>
</tr>
<tr>
<td>Maintenance</td>
<td>17</td>
</tr>
<tr>
<td>Guide rollers</td>
<td>17</td>
</tr>
<tr>
<td>Measurement frame</td>
<td>17</td>
</tr>
<tr>
<td>Transducer check</td>
<td>17</td>
</tr>
<tr>
<td>Trouble shooting</td>
<td>19</td>
</tr>
<tr>
<td>If the gauge measures wrong</td>
<td>19</td>
</tr>
<tr>
<td>If the gauge marks the strip?</td>
<td>20</td>
</tr>
<tr>
<td>Repairs</td>
<td>21</td>
</tr>
<tr>
<td>Transducer installation</td>
<td>21</td>
</tr>
<tr>
<td>Width Measurement Frame</td>
<td>23</td>
</tr>
<tr>
<td>Operation</td>
<td>24</td>
</tr>
<tr>
<td>Zero checking/adjustment</td>
<td>24</td>
</tr>
<tr>
<td>To check measurement accuracy</td>
<td>24</td>
</tr>
<tr>
<td>To remove/install the width measurement frame</td>
<td>25</td>
</tr>
<tr>
<td>To remove/install the width measurement transducers</td>
<td>25</td>
</tr>
<tr>
<td>Important Note</td>
<td>25</td>
</tr>
<tr>
<td>Setting of the limit stop rings</td>
<td>28</td>
</tr>
</tbody>
</table>

*Subject to change without prior notice*
Safety Precautions, please read carefully!

This gauge is meant to be used exclusively as a fix mounted component of a strip processing machine. The strip processing machine must not be started up until a written statement was made that the entire machine (into which the gauge is installed) is in accordance with the regulations of the EG-Maschinenrichtlinie 89/392/EWG. The manufacturer hereby points out, that this includes the installation of an appropriate protection device. The protection device has to be made in such a way that the operator can pull the gauge on the strip and push it off the strip during the rolling process without facing any hazard by the running or by the possibly breaking strip.

This manual has to be handed to the machine operator, and one copy must be permanently available to operator and service personnel.

Nobody is allowed to work on or with the gauge, before he has read and understood this manual. Feel free to call the Vollmer company in case of any questions (phone +49 2334 507 0).

Hands or fingers which are put into the vertical guide behind the gauge or into the slidebase below the gauge, might get caught and heavily injured if the gauge head moves up/down or is traversed.

The pneumatically operated guide rollers might cause injuries on hands and fingers. Under certain conditions, the guide rollers might close the gap unexpectedly. Therefore the pneumatic system must be depressurized before anybody starts to work on this gauge.

The gauge head might get hot. Therefore check the temperature before trying to handle the gauge head.

Intended use of this machine

This gauge must be used exclusively for the measurement of cold strip. It must be firmly installed in its intended position and electrically, electronically, hydraulically and pneumatically connected as intended by the Vollmer company. Any alteration might cause severe damage.

Spares

Please order spares referring to the part number and drawing number of the enclosed documentation drawings. To speed up our work, please do also state the Project number which is written as P-Nr. on the identity plate of the gauge.
Design and Function

The new VBK 593/12 is designed to measure simultaneously thickness and width of narrow strip and profile on mills or on inspection lines. The gauge measures the passing material continuously in its measurement mouth which has a depth of 50 mm. In order to ease the reading, the following sections of this manual will not continue referring to strip and profile, but only to strip.

The strip first passes the C-shaped thickness measurement frame with two thickness feelers measuring the running strip simultaneously from the top and from the bottom. This can be done by single measurement or by sum measurement:

**Thickness measurement by the standard version**

- **Single measurement** means to measure strip thickness between a movable LVDT transducer and a micrometer fine adjustment feeler. It puts out fine results on slow running strip.

- **Sum measurement** is used to measure fast running strip with high quality surface. Two electronic transducers measure the strip from both sides. As only a small amount of mass has to be moved instead of the entire C-frame, the two transducer tips are able to follow the surface even of vibrating strip.

Both measurement methods provide results of high accuracy, but they require different ways of gauge adjustment.

Due to strip thickness changes, the transducer tips are pushed apart or come closer. The transducer tips are crowned and polished diamonds, which do not leave any marks on the strip.

At its rear side each transducer has got a differential transformer. The movable core of this transformer is connected to the measurement tip which is sliding on the strip surface. In this way any movement of the measurement tip is measured inductively.

All changes within both transducers are passed to a VMF measurement amplifier, where they are added (sum measurement). The amplifier indicates a measurement result as deviation from zero, i.e. the difference to the preset nominal size.

There are two ways to adjust the gauge to nominal size: Either the upper transducer is adjusted within a micrometer thread or the measurement value is electronically converted. In both cases the measurement amplifier will indicate 0 when the measured strip thickness matches the nominal thickness.

The C-frame can be shifted within the gauge head across the passing material. This allows to measure any required track e.g. of a profile.
Thickness measurement by adjustable C-frame

As an option, the VBK 593 can be made with an adjustable thickness measurement frame. This special equipment allows to achieve very tight tolerances.

In this version, a double action pneumatic cylinder can pull the thickness measurement frame off the running strip any time. With the transducers off strip, the basic measurement value can be set to zero without pulling the entire gauge off the strip.

The two limit stop switches (optional items) detect whether the C-frame is in measurement position or in zero setting position. The rear switch starts the automatic zero setting routine (A0, optional). The front limit stop switch enables/disables e.g. the automatic mill controlling.

Width Measurement

Strip width is measured by a second, U-shaped frame. In most cases the width measurement frame has one LVDT transducer and one dead measurement pin, which measure the strip width by single measurement. As an option, strip width can be measured in sum by two LVDT transducers. The width measurement tips are polished, cylindrically shaped diamond edges, which can measure the strip width even on wavy edges. The clamping fixture of the transducer resp. the measurement pin on the operator's side can be set to different nominal sizes in its micrometer thread. The micrometer thread can be locked to prevent the micrometer tip from dislocating due to strip vibration.

The U-shaped width measurement frame is installed upside-down, so that it is open at the bottom. It can be lifted pneumatically, so there is no need to feed the strip into the gauge when starting a new coil. After the rolling started, the gauge can easily be pulled on strip where the width frame is then lowered.
The gauge is suspended vertically movable in its vertical guide which holds it in the correct passline height. Guide rollers hold it always parallel to the strip surface.

VBK 593/12 E/Su: The two thickness measurement transducers (left) are measuring in sum. Strip width is measured with single measurement by one transducer and one dead measurement pin in the U-shaped width measurement frame, which is open at the bottom side.

Amplifier measurement data can be used as signal for controlling and for quality control documentation according to ISO 9000. It is available on two analog voltage outputs. Some VMF amplifiers provide additional digital data outputs.
System

The VBK 593 gauge is always installed with a VMF measurement amplifier. This measurement amplifier indicates the difference between measured strip thickness and selected nominal size.

Nominal size setting

If the required material thickness - e.g. 500 µm - is entered as nominal size and if the measurement is 501 µm, the amplifier will indicate +1 µm.

So it is possible to stay within the highest sensitivity range of the indicator no matter of the material thickness. In this range the full deflection of the indicator covers a range of +/-10 microns.

Nominal size can be set in two ways:

- **mechanically:**
  The upper thickness transducer or the transducer resp. the measurement pin on the operator's side can be set to the selected nominal size by means of a micrometer thread. The setting is indicated e.g. mechanically by a digital turns counter or electronically by a ME-device.

- **electronically** (sum measurement with two LVDT transducers):
  there is no mechanical transducer adjustment, but the measurement value is electronically compensated for the nominal value by the setting of a thumb wheel switch, so that the selected nominal size is indicated as zero.
This electronical adjustment is limited to 2-3 mm, depending on the transducer type. It can be combined with a so-called "Di-So" device, i.e. the adjustable transducer is mechanically set to a certain nominal size, and from that position it can be electronically adjusted to different nominal sizes.

Measurement amplifier VMF 311 with electronic classifier 2S (top) and nominal size selector FS4 (bottom).

The measurement amplifier continuously indicates the difference between nominal and actual strip thickness. The operator can select the resolution of the analogue indicator by the measurement range selector MB. Full deflection can indicate from 1000 microns (.030") down to 10 microns (.0003"). The zero potentiometer NP allows to eliminate small deviations of the gauge zero. Tolerance limits can be set by the two-digit switches DK of the electronic classifier. Coloured control lamps indicate whether the measurement value is in, over or below tolerance. Such classifiers are optional equipment, their operation is described in a separate manual.

The (optional) nominal size selector FS4 shows the selected nominal size in microns (or steps of 0.0001", depending on the FS4 type).

The amplifier VMF 2000 includes all components described above. It puts out the measurement data with statistic evaluation ready for quality control documentation according to ISO 9000. Its internal automatic adjustment provides the best possible measurement accuracy at any time.

The VMF 2000 amplifier is capable of processing transducer signals of overall 4 mm measurement stroke (instead of 2 mm like the VMF 3/11 and 3/22 types). Those Transducers and the VMF 2000 amplifier can be used to upgrade nearly all Vollmer gauges.
Types

According to individual requirements of our customers, Vollmer gauges are produced in many different types. The gauge card at the beginning of the documentation shows the type of your gauge. The following list is a general overview about the most common items:

e.g.: **VBK 593/12E/FS4/Su/K/A0/DAV/2S/3**

Meaning of the abbreviations:

**VBK 593/1E/Su/2 E:**
Thickness and width gauge, thickness measured electronically and in sum (1E/Su), width measured electronically in single measurement (2E), measurement depth up to 50 mm from the strip edge.

Single track thickness gauges are identified as VBK 593/1, and width gauges are named VBK 593/2.

**Su:**
Measurement by 2 transducers in sum; accurate measurement values even in case of strip vibration.

**FS3/FS4:**
Remote selection of nominal size by a thumb wheel with 3 or 4 decades.

**K:**
Air cooling of the diamond measurement tips; against short-term drift, if the measurement tips are heated by the strip.

**A0:**
Electronic adjustment system, which works when the gauge is in its rear limit position. The amplifier adjusts itself to zero. A0 is mostly started by pressing a key.

**DAV:**
The diamond measurement tips of the two transducers are pneumatically pulled apart when the gauge is traversed in order not to damage them at the strip edge. For measurement of wavy strip the measurement pressure can be pneumatically increased to prevent the measurement tips from leaving the surface.

**2S dig:**
Digital electronic classifier, decade switches to set upper and lower tolerance limit. "In tolerance" values are indicated by a green control lamp, below tolerance is shown red and exceeding the upper limit is indicated by a yellow lamp.

**3:**
The gauge’s slidebase has a stroke of 300 mm.
Measurement head adjustment

Installation

When the gauge is installed into an inspection line, installation height and levelling of the gauge are derived from the inspection table. If the gauge was removed from its position, take care to reinstall the slidebase angular to the passline.

In rolling mills the gauge should be installed as described in the following sketch:

![Diagram of gauge installation](image)

*If possible, the gauge should be positioned between the roll gap (mill = W) and the deflector roll U. Base and the bracket K are so high that they lie under the strip by the "passline height" H (see data drawing in the documentation). Here the stroke of the vertical guiding is able to follow the expected range of strip movement.*

Additional conditions are:
- base parallel to roll axes in the mill
- slidebase rectangular to the strip
- gauge must be able to traverse towards the roll middle
Levelling

If the strip does not run horizontally, the gauge head can be turned: Loosen clamp screw X at the rear of the gauge. Lift the gauge at the front, adjust it to the strip passline angle and clamp it again.

Passline height

The upper limit stop of the vertical guide should be set to a position where the lower guide rollers touch the strip edge with the upper third of their slope.

Loosen lock nut Y below nut Z, and use nut Z to adjust the gauge head to an appropriate height. Finally tighten lock nut Y.

The large aluminium knob W is used to set the tension of the suspension springs. The suspension should push the gauge head against the upper limit stop of the vertical guide, but not too hard, so that the strip is not lifted by the gauge head. In that case please do reduce the spring load. It is set correctly, when the gauge head is slightly lowered by the strip when it is forwarded to the measurement position. When measuring very thin strip, the bottom limit stop might be lowered a little, so that the lower guide rollers put less load to the strip. However, the height must not be reduced too far, so that the lower guide rollers are permanently driven by the passing strip.

Measurement depth of the thickness frame

The knurled brass nut 20 can be turned to shift the C-frame backwards and forward. This allows to measure strip thickness at any distance up to 50 mm from the edge.
90° position and measurement frame spring load

If the gauge is measuring with a fine adjustment (single measurement) the strip edge will touch the slope of the (top side) fine adjustment in the forwarding gauge head, and will lift the C-frame for about 1.5 mm. This does push the transducer against the bottom strip side. The more load from the C-frame is resting of the tip of the fine adjustment, the better both measurement tips will follow the strip surface. Limit for that load is the hardness of the strip surface. The load should be reduced when the gauge marks the strip. Also the measuring of very thin strip might require a reduced measurement load. For measurement load reduction loosen the lock nut and tighten the knurled brass nut 50 (turn clockwise).

If the gauge is measuring with two transducers in sum, the C frame is held in a levelled position (90° position) by screw T. It can only move towards the top, as a protection against overloading. Sum measurement frames have no screw 50 as there is no need to set the tension. Measurement pressure is determined by the transducer. The measurement frame is held levelled because it leans against screw S with its own weight.
Upper guide rollers

The upper guide rollers are linked by the body plate of their vertical guiding. These rollers stabilize the gauge on the strip. If the gauge is measuring in sum, there is no need, that the upper guide rollers touch the strip continuously. When measuring sensitive material, it is recommended to set the guide rollers apart about half a millimetre wider than the strip thickness. The upper guide rollers can be lifted or lowered by turning the silver knurled screw 73.

In case the gauge starts to swing up and down, the operator should reduce the gap between the guide rollers.

Width measurement frame height

Set screw 96 determines the measurement height position of the width measurement frame. It forms the bottom limit stop for the lowering frame after the compressed air supply for pneumatic cylinder 64 was shut. By screw 96, which is secured by a lock nut, the height of the diamond measurement edges can be set to the appropriate measurement height.
Measurement

Zero check

Zero checking should be performed regularly. Set the gauge to nominal size zero and check the VMF indication. It should be zero. Minor deviations can be eliminated by setting the measurement amplifier (by means of the function Zero of the VMF 2000 or by the zero point potentiometer of the VMF 3/11-3/22).

In your gauge has an adjustable thickness measurement frame (see page 5) the thickness measurement frame can be pulled off the running strip. This is done by switching the pneumatic control valve to 'C-frame off strip'.

If the C-frame has two non adjustable transducers and the A0-function (option) the shifting is (optionally) controlled by two limit stop switches. The rear one starts the automatic zero setting (A0). During this routine, the nominal size signal is automatically switched off and the VMF measurement amplifier is automatically set to zero. As soon as this limit stop switch is set free, the nominal signal input into the VMF is enabled.

If the C-frame has an adjustable transducer the shifting is controlled by a single limit stop switch (optiona) on the front. When the C-frame is in the rear limit position, the nominal size is set to zero manually and the VMF amplifier can manually be set to zero. Then the nominal size has to be set newly.

Now set the pneumatic control valve to 'C-frame on strip'. When the C-frame reaches the measurement position, the front limit stop switch (option) puts out a signal which can be used e.g. to enable the automatic mill controlling.

Nominal size and tolerance limits

After the zero check, nominal strip thickness and width are set mechanically (by fine adjustment/micrometer) or electronically by the optional FS4 thumb wheel switch.

The upper and lower tolerance limits in microns can either be entered into the electronic classifier 2S or 4S (optional item, see separate instructions) or into the VMF 2000 amplifier (optional item, see separate instructions).

Measurement start and end

Now operate the pneumatic valve to lift the upper guide rollers and the width measurement frame. When strip tension is on, pull the gauge on the strip by its black lower ball hand lever. Switch the pneumatic valve again to shut the guide rollers and to lower the width measurement frame.
Measurement amplifier and classifier do now indicate the difference between nominal and actual size and whether the measurement value is in or below tolerance, or if its exceeds the limits.

**Important note:**

*Please do always push the gauge off the strip before the strip tension is switched off!*  
*The strip end must not pass the gauge, as it may cause serious damage.*

**Continuous check**

In between the service intervals, check the gauge regularly:

**Symmetry check:** Adjust nominal size to 0, move both transducer tips up and down, (indication has to be 0 µm +/-0,5). In case of tight tolerances check daily, otherwise weekly; depending on gauge application and on type of measurement amplifier this procedure can be run fully or semi automatic (see extra manual).

**Accuracy check with slip gauge:** Set the gauge to the nominal size of the slip gauge, and insert slip gauge between the transducer tips. The indication should be zero. In case of tight tolerances check daily, otherwise weekly.

**Transducer position to the strip:** The transducers must stand perpendicular to the strip. Lift the upper guide rollers and put the test plate onto the lower guide rollers. Tip it to both sides as well as to the front and to the back (see above, sketch 1 through 4). The display may only deflect to +. If not, check the whole gauge. This check is recommended after a strip breaking or other hard treatment.
Guide rollers: Check for easy rotation.

Passline: Check the correct height of the gauge to the strip

Safety precautions

As the gauge has pneumatically operated upper guide rollers, it is not allowed to work between the rollers unless the air supply for the rollers (at the rear side of the gauge) is disconnected; DANGER OF FINGER INJURIES

Strip breaking

The gauge is mounted onto the slidebase with a shear block. This is to prevent the gauge and its suspension from destruction in case of strip breaking. Shear block B is made from cast iron and easy to replace. In case of overload it shears off, so that the gauge and its suspension can move with the broken strip.

Please check the gauge zero after each strip breaking. If it has not changed, measurement can continue immediately.

If the gauge zero has shifted for a minor amount, set the measurement amplifier to zero and check the symmetry. Check the gauge with a slip gauge, which is integrated into the adjustment plate (addition, available from Vollmer). If these points are all right, measurement can go on.

If the symmetry is disturbed, or if the measurement does not indicate the exact thickness of the sample, check the whole gauge. Take special care of the diamonds, the easy movement of the transducer rams and the alignment of the transducer holes in the C-frame.
Maintenance

The thickness gauge does not need much maintenance. Only the measurement tips with the diamonds and the guide rollers are subject to wear. From time to time the gauge should be cleaned in order to avoid dirt deposits which might block movable parts.

At least the following points must be checked regularly, even if measurement results and symmetry are correct

Guide rollers

- Clearance?
  The rollers have to move freely. They should have only little axial clearance. Blocking rolls mark the strip.
  ⇔ Replace defective rollers

- Deposits on the surface?
  Some strip materials leave deposits on the rollers. They cannot run smooth on the strip and might mark the strip.
  ⇔ replace rollers (rework if possible)

- Roller support defective?
  Check regularly, if the upper guide rollers run smooth in their vertical ball guides, and if they move down to their mechanical limit stop when the compressed air is switched off.
  ⇔ clean the ball guides if the rollers get stuck

Measurement frame

- Easy movable?
  The C-frame might get stuck because of major dirt deposits in the gauge mechanics, or if after long time of operation the C-frame bearing is worn. This might cause measurement errors.
  ⇔ Clean the gauge, send it to Vollmer for repair if the bearing is defective

Transducer check

- Ram easy movable?
  The transducer rams must be easy to be pushed in and spring back immediately.

- Measurement tips worn or damaged?
  If the measurement result of the slip gauge plate is not 0, but the other checks are all right, remove the transducers and check the measurement tips:
- Diamonds worn?
  The diamonds should be crowned to achieve accurate measurement results. Worn diamonds with flat spots may cause measurement errors.
  ⇒ Replace and possibly get the old diamonds reworked

- Broken diamonds?
  Cause incorrect measurement results and mark the strip
  ⇒ Replace

- Measurement tips with broken-out diamonds? (after strip breaking or when the strip end has passed through the gauge)
  ⇒ Replace

- Micrometer thread damaged?
  Worn micrometer threads cause measurement errors. Check: Set the transducer to zero, select a nominal size and insert the correspondent slip gauge. Try with several slip gauges. The indication has to be very close to zero. If not,
  ⇒ send the transducer to Vollmer for repair.

- Measurement frame distorted?
  Take a 20 mm inspection pin to check the alignment of the transducer clamp bores in the C-frame. The pin must slide easily through both bores. If not, do not try to straighten the C-frame by yourself,
  ⇒ send it to Vollmer for possibly repair
Trouble shooting

If the gauge measures wrong

- Wrong point remeasured?
  Cross profile strip thickness varies in many cases. If the gauge is checked, strip thickness must be measured in the same distance from the edge as the transducers have measured.
  - check the strip thickness at correct edge distance

- Transducers dirty?
  In a very dirty environment, the rams of two transducers sometimes get too sticky, so that they do not shut completely. If the gauge is then set to zero, the indication of a following measurement is too low. After cleaning the transducer ram should slide easy in its bushing or bearing for a quite long period of time.
  - increase cleaning frequency

- Transducers clamped too hard?
  If the clamp screws in the C-frame are clamped too hard, they possibly distort the transducer housing which increases the friction in the ram guiding.
  - loosen the clamp screw and re-tighten them with moderate force

- Oil in the flexible cable protection hose?
  Although the oil does not damage the transducer, it increases the friction of the ram guide bushing or ball bearing. In that case the transducers cannot continuously keep contact to a vibrating strip surface. The measurement then indicates "too thick". Much oil in the protection hose does additionally choke the diamond lifting.
  - Drain the oil from the hose by opening the drain screw in the white plastic DAV connector (see extra DAV instruction). Clean the transducer and possibly improve the quality of the supplied compressed air.

- Gauge zero not constant?
  If the screws, which connect the measurement ram with the guide ram, are not tight, the measurement ram might move against the guide ram.
  If, for example, DAV was activated or material was placed between the transducers and then removed, the zero point changes. The indication is incorrect even if the symmetry is correct.
  - Fasten the grub screws in the guide ram (see transducer manual)

- Short-term drift of the gauge zero?
  Can be noticed, if the rolling has been finished and the gauge in its rear position is directly set to zero (without pushing A0). If the display drifts away to + or -, the diamond cooling does not work correctly. Check, whether the small air pipes are not bent. The jet should meet the diamond tip of the transducer.
  - Readjust the cooling at the pressure valve "cooling" in the pneumatic cabinet (if the indication drifts away to minus -> increase the cooling, if the indication drifts away to plus -> reduce it)
- **Indication too low?**
  If the transducers in the C-frame are clamped not tight enough, they might be shifted in their bore. Gauge zero is then shifted too.

- **Indication wrong?**
  If the fine thread of the upper transducer is defective, the nominal size setting is disturbed (see section Transducer check”).

- **Indication correct at zero but wrong at other values?**
  Check the transducer symmetry by moving up and down both transducer tips. If the indication does not stay 0
  ⇒ readjust the transducer symmetry

- **Indication too high?**
  Put a test plate onto the lower guide rollers and tip it to both sides as well as forward and backward. The indication should deflect only towards +.
  If not,
  ⇒ check the complete gauge (measurement tips for wear, C-frame for 90° position and C-frame distortion)

- **Indication too high?**
  If the strip breaks or a strip end passes through the gauge, the C-frame is possibly bent. The indication is too high. Check as before and
  ⇒ check the alignment of transducer clamping bores with a 20 mm inspection pin

**If the gauge marks the strip?**

- **Diamond with small cracks?**
  If hit too hard, the diamonds in the transducer measurement tips might get tiny ring-shaped cracks, which are hardly visible. Sometimes such crackles mark the strip
  ⇒ replace the measurement tip

- **Diamond broken out?**
  In case of strip breaking the diamonds might break out of the measurement tips.
  ⇒ replace the measurement tip

- **Roller blocked?**
  Replace roller. If the roller surface is not damaged, replace only the bearings.
Repairs

Transducer installation

For transducer service or repair (see separate manual) the transducers can easily be removed from their clamping bores in the measurement frame. The gauge requires new adjustment and calibration after the transducers were reinstalled.

At first only one transducer is installed and positioned against a Vollmer fine adjustment. It is then used to find the 90° position of the C-frame. After that, the fine adjustment is replaced with the second transducer which is then zeroed by means of the VMF indication. Please do never swap the transducers. Here is the description of the entire procedure:

First lift the upper guide rollers and put the adjustment plate onto the lower guide rollers.

Insert a fine adjustment into the upper clamping bore of the C-frame and set it in such a way that the measurement frame seems visually to be levelled in the so-called 90° position.

Now connect the bottom transducer and select the 1000 µm measurement range (the upper transducer is not connected to the measurement amplifier). If there is a nominal size selector, set it to zero. Push the transducer up in its bore until the amplifier indicates zero and clamp it.

Now tip the adjustment plate on the lower guide rollers to all four directions, see sketch 1 through 4. The indicator must be deflected at any time exclusively towards the + side. If not, the gauge might measure inaccurate:

- If "minus" is indicated when the plate is tilted towards the front, the transducer end of the measurement frame is to low
- Loosen the clamp of the bottom side transducer, pull it back for a little, and turn the fine adjustment to set the indication back to zero.
If "minus" is indicated when the plate is tilted towards the back, the transducer end of the measurement frame is too high.

Loosen the clamp of the bottom side transducer, push it up for a little, and turn the fine adjustment to set the indication back to zero.

If "minus" is indicated when the plate is tilted towards one side (sketches 1+2), either the transducer tips are worn or the C-frame is distorted.

If the indication is deflected to minus, theoretically there might be one transducer with a diamond that is not perfectly centred. This is easy to check by turning the transducer clockwise in 90° steps. Then it is easy to check if the error follows in the same direction when tilting the adjustment plate.

If the measurement frame is positioned correctly, secure that position by the set screw S (see page 11). Turn screw S in until it touches the limit stop without lifting the C-frame (watch the indicator). The pull out the adjustment plate and watch the C-frame. It must not drop down.

After the C-frame is in its 90° position, re-insert the adjustment plate and loosen the clamp of the bottom transducer. Push it up against the adjustment plate until the amplifier indicates the required value. That value depends on the type of the gauge (see gauge card in the documentation) and the application. We marked the paragraph with the correct data for your application:

Transducers with 1 mm stroke (20-MUBE-0/20 MOBE-0) and measurement amplifier VMF 3/11 or 3/22 or 2000: clamp lower transducer at +500 µm

Transducers with 1 mm stroke (two 20-MUBE-0) and measurement amplifier VMF 3/11 or 3/22 or 2000: clamp lower transducer at +800 µm. If measuring only strip below 1 mm, clamp the lower transducer at +500 µm

Transducers with 2 mm stroke (series -90 or -92, 20-MUBE/20 MOBE), and measurement amplifier VMF 2000: clamp lower transducer at +1000 µm

Transducers with 2 mm stroke (series -90 or -92, two 20-MUBE), and measurement amplifier VMF 2000: clamp lower transducer at +1500 µm. If measuring only strip below 1 mm, clamp the lower transducer at +1000 µm

Then take off the adjustment plate, select measurement range 10 µm and connect the second transducer. On a transducer with a micrometer thread the rear part should be turned clockwise to the limit stop, and then back for one full turn. Then insert the upper transducer and push it against the lower one until the measurement amplifier indicates nearly zero. Minor deviations can be eliminated by the zero point potentiometer (VMF 3/22 + 3/22) or the Master key (VMF 3/2000).

Then check the strip thickness gauge with a slip gauge. If the error exceeds 1 µm, check the VMF adjustment to the nominal size selector, the transducer measurement tips and the transducer symmetry.
Width Measurement Frame

VBK 593 with width measurement frame and ME (electronic nominal size indicator). On this gauge, thickness as well as width are measured in sum.

This section of the manual is about the VBK 593 width measurement frame. For more details about the installed transducers see the Transducer Service Manuals.

The strip must be guided laterally on the in-going and on the outgoing side of the gauge, so that it will pass through the gauge exactly rectangular to the roller's axes. If the strip is not guided properly, the width measurement might put out wrong results.
The strip width transducers are installed in a C-shaped measurement frame, which is installed in a ball guide so that it can easily follow lateral movements of the strip.

The strip width is measured between two measurement feelers. Depending on the gauge type, either both of them are electronic transducers, or one of them is a fine adjustment. The fine adjustment or one of the transducers can be set (by means of a fine thread) to the strip's nominal width. The nominal size setting can be indicated mechanically or electronically depending on the transducer type. The gauge shown on the front page of this manual has ME-indicators, i.e. the adjustment is indicated digitally. Standard width measurement range is 0 to 25 mm, but the gauge can be designed to measure a wider range (option).

The measurement amplifier indicates zero as long as the measured width meets the selected nominal size.

**Operation**

Before inserting a strip, check if the gauge's measurement tips are set wide enough apart. If the gauge is set to a smaller width than the actual strip, the measurement feelers might get damaged.

**Zero checking/adjustment**

If there is no strip in the gauge and if gauge is set to nominal size zero, the measurement amplifier must indicate zero. Minor deviations can be eliminated by the function Zero (VMF 2000/1000) or by the zero point potentiometer (VMF 3/11 or 3/22). Now insert a material sample of a width of 1 mm between the measurement tips and take it out again. The indicator must return to zero. If not, read the section 'Trouble Shooting' of the VBK 593 main manual.

**To check measurement accuracy**

If the gauge shows a constant zero point (see above), the gauge's measurement accuracy may be checked with a slip gauge (optional item). First set the strip width gauge to the nominal size of the slip gauge and then insert the slip gauge between the feeler tips. If the measurement feelers measure the slip gauge exactly rectangular, the indication must be close to zero ($\pm 0.5 \mu m$). If not, check the gauge.
To remove/install the width measurement frame

The transducers and the fine adjustment can be removed from their clamp holder for service or repairs. The gauge requires new adjustment after the feelers are re-inserted.

Remove the front limit stop FL and then pull the width measurement frame off towards the front. The rear limit stop ring RL should not be moved. After the width measurement frame was re-inserted, clamp FL to a position where it allows the width measurement frame a clearance of 3.5 mm between RL and FL. This distance results from the measurement stroke of the two transducers which adds up to 4 mm. If the gauge has transducers with a measurement stroke of only 1 mm, the required clearance is 1.5 mm.

To remove/install the width measurement transducers

Both width measurement transducers are clamped in their holdings. The clamp screw is below the corresponding transducer and is accessible from the right hand side (i.e. the same side which is shown on the photograph above). The rear transducer cannot be removed unless the width measurement frame is removed from the gauge.

Important Note

The measurement tips of width transducers are different from the tips of thickness transducers. The diamond tips of the width transducers have a cylindrical shape, so that they can measure the strip edge even if it is a little wavy. When installing a width transducer, you must take care to clamp the transducer in a position where the measurement edge is perpendicular to the strip edge!
It is recommended, to remove only one transducer at a time. In that case, the installation of the removed transducer is very easy: Just set the gauge to nominal width zero and re-insert the removed transducer. Connect both transducers to the measurement amplifier and clamp the loose transducer in that position where the amplifier indicates nearly zero. Minor deviations can be eliminated by the function Zero (VMF 2000/1000) or by the zero point potentiometer (VMF 3/11 or 3/22).

If both transducers were removed at the same time, set the ME counter to nominal size zero by turning the adjustment spindle. Disconnect the front side transducer and connect the rear transducer to the measurement amplifier.

Now insert the rear transducer loosely into its clamp holder and then install the width measurement frame to the gauge.

The front limit stop ring FL must be clamped in a position which allows the width measurement frame a clearance of 3.5 mm between RL and FL.

Then push the width measurement frame against RL, and put a straight piece of material as a ruler onto the guide rollers. Push this ruler against the rear collars of the bottom guide rollers.

When ruler and measurement frame rest against their limits stops as described above, push the rear transducer in until the indicator is on +800 resp. +1500 µm. The +800 µm value is for transducers with a measurement...
stroke of 1 mm, and the +1500 µm value is for transducers with a measurement stroke of 2 mm. Clamp the rear transducer in that position and remove the ruler from the gauge.

Now the transducer clamping fixture TH needs to be positioned before the transducer (resp. the dead measurement pin) on the operator side is put into the gauge. The position of TH is correct, if the gap between ME-housing and the rubber seal on the guide rod is 3 mm wide (see photograph page 26).

Now connect the front transducer to the measurement amplifier and insert it into its holder. Clamp it (resp. the measurement pin) in that position where the amplifier indicates nearly zero. Minor deviations can be eliminated by the function Zero (VMF 2000/1000) or by the zero point potentiometer (VMF 3/11 or 3/22).

Width measurement transducers and measurement pins are inserted in such a way that they meet in the middle of the measurement frame when they measure zero. Air cooled transducer tips should protrude from the cooling collar only with round or slope sections, but not with the cylindrical part of their tip.
Setting of the limit stop rings

Usually there is no need to move the rear limit stop ring RL. Therefore it forms the reference point for the setting of the front limit stop ring FL which is removed for taking off the width measurement frame. If both rings and both transducers are dislocated, first insert the two transducers into the width measurement frame and clamp them so that they meet in the middle of the frame and indicate zero in sum. On single measurement gauges install the micrometer and then the transducer as described in the previous section.

Now disconnect and remove the front transducer (resp. the fine adjustment) from the width measurement frame. Insert a straight piece of material (as a ruler) onto the guide rollers. Push this ruler against the rear collars of the bottom guide rollers. Now pull the width measurement frame with the lose ring RL towards the front until the amplifier indicates +800 resp. +1500 µm (see above). Clamp RL at this position. The front side ring FL is then clamped at a position which allows the width measurement frame a clearance of 3.5 mm. At last re-install the front side transducer into the width measurement frame.