THERMOVAC

TM101

Operating Instructions 300306186_002_A2

Part-No.: 230081V01 (TM101 incl. 9V battery)
Part-No.: 230082V01 (accessory set)

Content

1 Safety Instructions

- Read and follow the instructions of this manual
- Inform yourself regarding hazards, which can be caused by the product or arise in your system
- Comply with all safety instructions and regulations for accident prevention
- Check regularly that all safety requirements are being complied with
- Take account of the ambient conditions when installing your TM 101. The protection class is IP 40, which means the unit is protected against penetration of foreign bodies.
- Adhere to the applicable regulations and take the necessary precautions for the process media used
- Consider possible reactions between materials and process media
- Consider possible reactions of the process media due to the heat generated by the product
- Do not carry out any unauthorized conversions or modifications on the unit
- Before you start working, find out whether any of the vacuum components are contaminated
- Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts
- When returning the unit to us, please enclose a declaration of contamination
- Communicate the safety instructions to other users

Pictogram-Definition

Danger of personal injury

Danger of damage to the unit or system

Important information about the product, it's handling or about a particular part of the documentation, which requires special attention

2 The TM 101

2.1 For Orientation

These operating instructions describe installation and operation of products with part number 230081V01 (for serial no. higher than 2010-700) and 230082V01.

The article number can be found on the product's type label. Technical modifications are reserved without prior notification.

2.2 Delivery Content

230081V01:

- Thermovac TM 101
- Protective cover
- Operating instructions TM101
- AlMn block battery 9V

230082V01 (accessory set):

- Protective case
- Windows™ software VacuGraph™ with online help function
- USB interface cable
- Power supply 15V for mains voltage 100 – 240 VAC, 50/60 Hz, incl. exchangeable AC plugs type EURO, US, UK and AUS
- AlMn block battery 9V
- Operating instructions for power supply

2.3 Product Description

The TM 101 compact vacuum meter is measuring total pressure in the range 1200 – $5x10^{-4}$ mbar.
The unit is equipped with a Piezo/Pirani combination sensor and temperature compensated. It can be mounted to suitable flanges. When using a suitable battery, the instrument can also be operated completely under vacuum. Pressure is displayed continuously over the whole measurement range.

Due to the integrated data logger functionality it is possible to store up to 2000 measurements in the vacuum meter. By means of the USB interface you can transmit the stored measurement data to a PC or record measurements online on PC as well.

Measurement Principle
The TM 101 is equipped with an internal piezo-resistive sensor for measuring rough vacuum. Under the influence of pressure a thin diaphragm is bent, on it's back a resistor-bridge is applied. The bending forces the measurement-bridge to come out of tune, which is a measure for the applied pressure.
For the fine vacuum range a Pirani sensor is also integrated, which uses the heat conduction of gases for measuring vacuum. In a bridge circuit the filament is heated to constant temperature, the necessary bridge voltage is a measure for total gas pressure.

Warm-up-time
Pressure is displayed immediately after the unit is switched on. To take advantage of the maximum accuracy in fine vacuum range it can be appropriate to allow for stabilization time of 2 minutes, especially when extreme pressure changes have occurred.

Accuracy
Using two different physical sensor principles the TM 101 provides high resolution over the whole range. The unit is factory adjusted. Through contamination, ageing or extreme climatic conditions the need for readjustment may arise. Accuracy therefore may be reduced in the range below 10^{-2}mbar.

Dependency on gas type
Due to the Pirani sensor, measurements below 15 mbar are depending on composition and type of the gas being measured. The unit is adjusted for N_2 and dry air. With He and CO deviations will be almost negligible below 0,5mbar.
For other gas types a correction factor can be entered which affects measurements below 15 mbar and produces correct pressure readings below 0,5 mbar (see chapter 5.5).

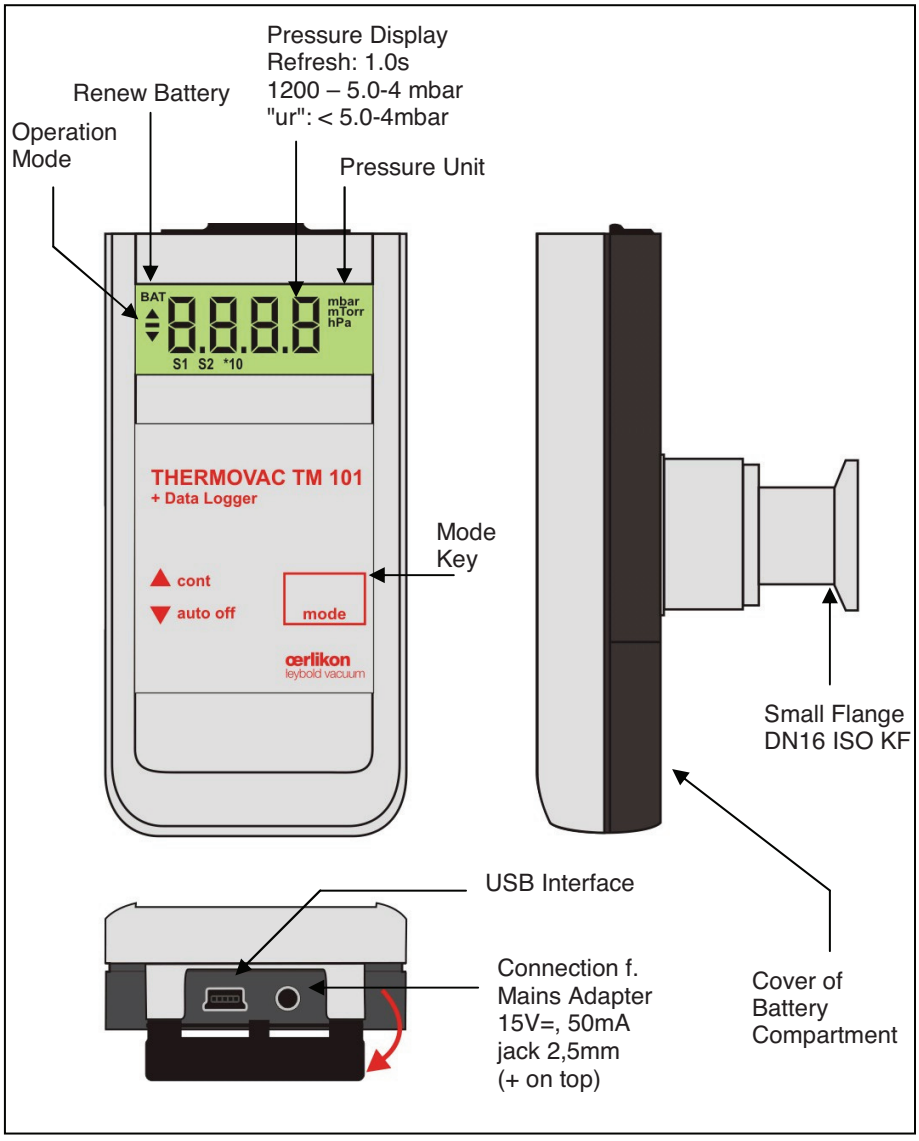
Proper Use
The TM 101 serves exclusively to provide total pressure measurements in the range 1200 – $5x10^{-4}$ mbar. It may only be connected to components specifically provided for such purpose.

Improper Use
The use for purposes not covered above is regarded as improper, in particular:
- the connection to components not allowed for in their operating instructions
- the connection to components containing touchable, voltage carrying parts.

No liability or warranty will be accepted for claims arising from improper use.

The user bears the responsibility with respect to the used process media.

2.4 Overview


Pressure Display
Refresh: 1.0s
1200 – 5.0-4 mbar
"ur": < 5.0-4mbar
Renew Battery
Operation Mode
Pressure Unit
BAT
mbar
mTorr
hPa
S1 S2 *10
THERMOVAC TM 101
+ Data Logger
cont
auto off
mode
ærlikon
leybold vacuum
Mode Key
Small Flange
DN16 ISO KF
USB Interface
Connection f.
Mains Adapter
15V=, 50mA
jack 2,5mm
(+ on top)
Cover of
Battery
Compartment

3 Installation

3.1 Installation Notes

Unauthorized modifications or conversions of the instrument are not allowed!

Installation location: Indoor
For not fully air conditioned open buildings and operation rooms:
Temperature: +5℃ ... +50℃
Rel. Humidity: 5 - 85%, not condensing

3.2 Vacuum Connection

Dirt and damage, especially at the vacuum flange, have an adverse effect on the function of this vacuum component.
Please take account of the necessary instructions with regard to cleanliness and damage prevention when using vacuum components.

- Remove the protective cover (is required again during maintenance work!)
- Make vacuum connection via small flange DN16 ISO KF; it is recommended to have the vacuum vessel electrically grounded
- Use metal clamps, that can be opened and closed with appropriate tools only (e.g. strap retainer-tension-ring)
- Use sealing rings with a centering ring.

Overpressure in the vacuum system
Accidental or unintended opening of clamp elements under stress can lead to injuries due to parts flying around!
KF flange connections with elastomer sealings cannot withstand pressures above 1.5 bar. Process media thus can leak and possibly damage your health.

3.3 Electrical Connection

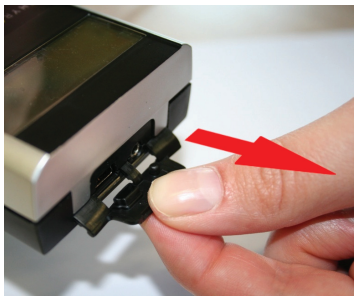
Battery operation

Before operating the TM 101 a suitable battery or rechargeable battery must be inserted.
For this purpose pull the battery cover on the back of the unit downwards and insert the battery as shown on the pictures below. Close the cover again by pushing it upwards until it snaps into position.

Battery types:

- 9V AlMn block battery type 6LR 61; lifetime max. 40h
- 9V Lithium block battery; lifetime max. 100h

Poor battery power is indicated by the ‘’BAT’’-prompt in the upper left corner of the display. The device still can be used. Only when the battery is flat the vacuum meter is switched off. Rechargeable batteries have to be removed for charging. Please use suitable, commercially available chargers.

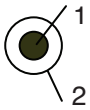


The sockets for the plug-in power supply and USB are located behind a protective rubber lid.

To access the sockets please carefully open the lid and pull it out slightly!

Operation with external mains adapter

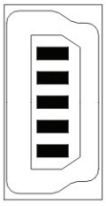
Alternatively to battery operation the TM 101 can be supplied by an external 15V plug-in mains adapter (accessory).



jack plug 2,5mm
1: 15V
2: AGND

An inserted battery can be left in the TM 101 when a plug-in mains adapter is used.
For the recharging of batteries suitable, commercially available chargers have to be used.

3.4 USB Interface



Mini Jack Type B
1: VCC, +5V
2: Data –
3: Data +
4: GND
5: GND

The USB interface can be connected to a PC. In combination with the VacuGraph™ Windows™ software, for instance, you can read-out the data memory of your TM 101, transmit measurements online to the computer or configure the vacuum meter.

4 Operation

4.1 Short Time Pressure Display / Auto-Off Mode

Switch-on the gauge by pressing the Mode-Key:

The actual pressure is displayed.

After 20 seconds the vacuum meter is automatically switched off.

4.2 Continuous Pressure Display / Cont Mode

(Available only when data logger function is disabled!)

Switch-on the gauge by pressing the Mode-Key, then Press Mode-Key again within 20 seconds:

The gauge is now operating in Cont Mode and the actual pressure is displayed.

In Cont Mode the instrument keeps operating continuously, until it is switched-off manually or, after the maximum operation time has elapsed, automatically (see chapter 5.4)

Switch-off the gauge:

On further keystroke in Cont Mode the unit returns to 1) Auto-Off Mode.

4.3 Pressure Display with Data Logging

To operate your TM 101 as a pressure display with data logger functionality activate the logging function as described in chapter 5.1.

Before a new data logging is started the internal memory of the gauge must be cleared! This means that only one continuous measuring process can be saved at a time!

1) Short-Term Operation (Auto-Off Mode)

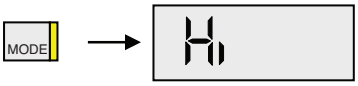
Press Mode-Key:

The actual pressure is displayed.

After 20 seconds the vacuum meter is automatically switched off.

2) Stored Maximum Pressure:

Press Mode-Key again:

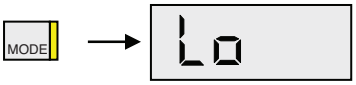


After two more seconds the stored maximum pressure is displayed:

Without further keystroke: return to 1) after 4s.

3) Stored Minimum Pressure:

Press Mode-Key again:



After two more seconds the stored minimum pressure is displayed:

Without further keystroke: return to 1) after 4s.

4) Delete Memory:

"clr" flashes in the display.

On further keystroke the stored Min-/Max-values as well as the data memory are deleted.
Without further keystroke: return to 1) after 4s.

5) Data Logger Mode:

The actual pressure is displayed.

The data memory is deleted. The TM 101 is in Data Logger Mode and from now on stores new extremal pressure values and –if applicable- up to 2000 measurements with the preset logging rate (see chapter 5.1).
The maximum time span for data recording arises from the capacity of the gauge's internal memory and the selected logging rate, e.g.:

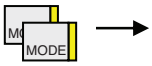
Logging rate 1 s → approx. 33 min
Logging rate 10 min → approx. 13 days 21 hours

For data storage a battery-independent memory-IC is used whereas the stored minimum and maximum values are lost when the battery is exchanged.

Data logging is stopped if no further memory is available, when the vacuum meter is switched-off or when it is connected to a PC via USB (see chapter 4.3).

In the Data Logger Mode the TM 101 keeps operating continuously until it is switched-off manually or, after the maximum operation time has elapsed, automatically (see chapter 5.4).

Switch-off the vacuum meter during data logging:



Press Mode-Key twice: return to 1) Auto-Off Mode.

4.4 PC Mode

For data transmission the TM 101 can be connected to a PC via USB interface. The VacuGraph™ Windows™ Software (accessory) supports online recording of measurements as well as the read-out of the TM 101 data memory. Measurements are plotted as a diagram and can be exported as text file for further analysis.

The separately saved values of minimum and maximum pressure cannot be transmitted to the PC.

Further you can perform any parameter settings such as logging rate, display unit or gas correction factor easily by means of the VacuGraph™ software.

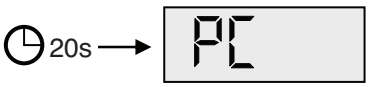
The TM 101 is switched into PC Mode as soon as a cable connection with a free PC USB port is established:

The TM 101 is now ready for bidirectional data transmission.

When the TM 101 is switched into PC Mode, actual pressure display as well as any data logging is stopped!

When an online measurement is started on the PC, the TM101 will display the actual pressure after each data query sent by the PC:

The display is switched-off automatically after 20 seconds if no further data queries are sent by the PC.

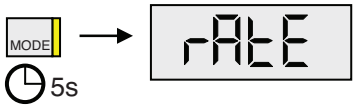


The injection of disturbing signals from the PC over the USB cable can give rise to a shift of the measurement signal in the range of a digit step! The effect can be reduced by having the instrument's flange connected to ground.

After the USB cable is disconnected the TM101 switches into Auto-Off Mode.

5 Configuration

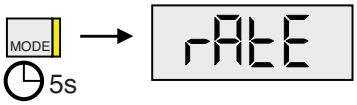
To switch the TM 101 into Configuration Mode:



with the instrument switched-off hold the Mode-Key pressed for approx. 5 seconds, until the display shows ‘’rAtE’’.

5.1 Logging Rate

To set the logging rate of your TM 101 and thereby activate the data logging functionality, switch the unit into Configuration Mode. For this the instrument must be switched-off. Hold the Mode-Key pressed then, until the display shows ‘’rAtE’’:



After additional 5s the current rate setting for internal data logging is displayed and can now be adjusted by means of the Mode-Key:
off, HiLo, 1,0s / 2,0s / 10s / 1min / 10min und trig.

"off" : data logging is disabled.

"HiLo" means that only minimum and maximum pressure is stored. These values can be displayed but cannot be transmitted to a PC!

Save measurements every 1.0 seconds.

...

"trig" means that new measurements are saved only if the new value differs more than 2 digits from the one that was stored last (e.g. 2.3 → 2.5). Data volume is reduced this way and optimum memory utilization achieved.

When data logging is active minimum and maximum pressure are recorded simultaneously.

Via USB interface the user can set logging rates between 1,0s and 6000s arbitrarily! The logging rate which was set last this way is also available for choice in the TM 101 display and shown after "trig".

Without further keystroke the vacuum meter is switched into Auto-Off Mode after 5 seconds. The last settings are saved.

5.2 Adjustment

The instrument is factory adjusted. Through use under different climatic conditions, through extreme temperature changes, ageing or contamination readjustment can become necessary.
To adjust your TM 101, switch the unit into Configuration Mode. For this the instrument must be switched-off. Hold the Mode-Key pressed then, until the display shows "rAtE".

Then press Mode-Key several times, until the display shows "CAL":

Adjustment on Atm

Consider altitude and use a trustable reference pressure! Adjustment on atmosphere pressure is possible only if the displayed actual pressure is above 800 mbar. Otherwise adjustment is denied and the error message "Err" displayed (see chapter 6, error messages and malfunction).

After 5 more seconds the display shows:

Press Mode-Key, the actual atmosphere pressure is displayed:

If "mTorr" is selected as pressure unit, the display will automatically change to "Torr" during the adjustment!

Using the Mode-Key you can now adjust the reference pressure: very keystroke changes the displayed value for another 1mbar alternating up- and downwards.

After 5s without further keystroke adjustment is performed:

During the adjustment procedure the display shows "CALI".

Afterwards the unit switches to Auto-Off Mode.

Adjustment on Zero Pressure

For adjustment on zero pressure the actual pressure inside the sensor has to be less than 1 $x10^{-4}$ mbar!
The pressure reading must be less than $4x10^{-2}$ mbar, otherwise adjustment is denied and the error message "Err" displayed (see chapter 6, error messages and malfunction).

Switch the unit to Configuration Mode like described above and press Mode-Key several times, until "CAL" is displayed.
After 5 more seconds the display shows:

After 5 more seconds the display shows:

Press Mode-Key for adjustment. During the adjustment procedure the display shows "CALI".

When the adjustment procedure is finished, the unit switches to Auto-Off Mode.

5.3 Pressure Units

To set the displayed pressure unit, switch the TM 101 into Configuration Mode. For this the instrument must be switched-off. Hold the Mode-Key pressed then, until the display shows "rAtE".

Then press Mode-Key several times, until the display shows "unit":

After 5 more seconds the current unit setting is displayed:

Using the Mode-Key you can now select "mbar", "Torr", "mTorr" or "hPa".

Without further keystroke, the unit switches to Auto-Off Mode after approx. 5 seconds. The last settings are saved.

5.4 Maximum Operation Time

When operating continuously in Cont Mode or Data Logger Mode the unit stays switched-on, until a selected maximum operation time has elapsed. To set this maximum operation time, after which the unit is automatically turned-off anyway, switch the TM 101 into Configuration Mode. Therefore the instrument must be switched-off. Hold the Mode-Key pressed then, until the display shows "rAtE".

Then press Mode-Key several times, until the display shows "hour":

After 5 more seconds the current setting of maximum operation time is displayed:

Using the Mode-Key you can now select a timespan from 1h to 24h or cont (no switch-off).

Without further keystroke, the unit switches to Auto-Off Mode after approx. 5 seconds. The last settings are saved.

Important note:
If a maximum operation time other than "cont" is set, the gauge will be switched-off anyway after the selected time span has elapsed. An active data logging will be stopped!

5.5 Gas Correction Factor

The output signal of the Pirani sensor inside your TM 101 and therefore the pressure reading of the gauge below 15 mbar depend on type and composition of the gas being measured. The device is adjusted for N_2 and dry air, for He and CO the deviation can be neglected below 0.5 mbar. For other gases a correction factor can be set which affects pressure reading below 15 mbar and produces correct readings below 0.5 mbar. The measurements of the Pirani sensor are hereby multiplied with the correction factor.

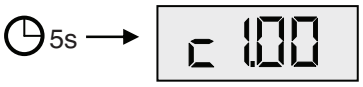
Correction factor Pirani:

Ar	1,6	CO_2	0,89	He	1,0	Ne	1,4
CO	1,0	H_2	0,57	N_2	1,0	Kr	2,4

To adjust the gas correction factor, switch the unit into Configuration Mode. For this the instrument must be switched-off. Hold the Mode-Key pressed then, until the display shows "rAtE".

Then press Mode-Key several times, until the display shows "corr":

After 5 more seconds the current factor setting is displayed:

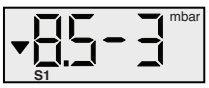


The setting range is 0.20 to 8.00.

The value can now be incremented by means of the Mode-Key. If you hold the key pressed the value counts up automatically to 8.00 and then restarts at 0.20.

Without further keystroke, the unit switches to Auto-Off Mode after approx. 5 seconds. The last setting of the gas correction factor is saved.

If a correction factor different from 1,00 is set, symbol "S1" is shown at the lower boundary of the display!



6 Maintenance and Service

Danger of possibly contaminated parts!
Contaminated parts can cause personal injuries. Inform yourself regarding possible contamination before you start working. Be sure to follow the relevant instructions and take care of necessary protective measures.

The unit requires no maintenance. External dirt and soiling can be removed by a damp cloth.

Should a defect or damage occur on the TM 101, please send the instrument to us for repair.

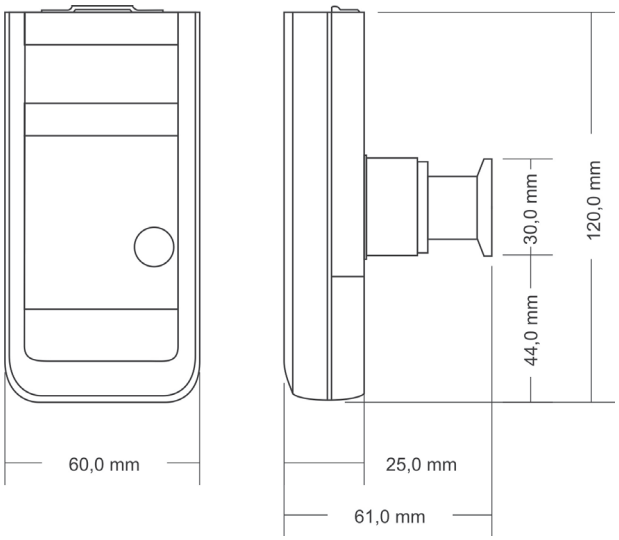
The unit is not planned for customer repair!

Malfunction of the unit, which are caused by contamination or break of filament are not covered by warranty.

Error messages and malfunction

Problem	Possible Cause	Correction
high measurement error	contamination, ageing, extreme temperature, maladjustment	readjustment
display shows "or"	pressure over range	(pressure > 1200mbar)
display shows "ur"	pressure under range	(pressure < $5x10^{-4}$mbar)
error message "Err"	adjustment done at wrong pressure measurement error out of adjustment range	displayed pressure must be >800mbar f. atmosphere adjustment, <$4x10^{-2}$mbar f. zero adjustment send unit for repair
error message "Err1"	defective sensor	send unit for repair

7 Technical Data



Measurement Principle	piezoresistive + heat conduction Pirani (gas type dependent)
Materials with vacuum contact	stainl. steel 1.4307, gold, nickel, tungsten, glass, Viton®
Measuring Range	1200 - 5,0x10^{-4} mbar (900 - 5,0x10^{-4} Torr) admissible overload 2 bar abs.
Resolution	1200 - 1000 mbar: 1 mbar 1000 - 1 mbar: 0,1 mbar < 1 mbar: 2 digits mantissa, 1 decimal place
Accuracy	1200 – 10 mbar: 0,3% f.s. (f. scale end) 10 - 2,0x10^{-3} mbar: 10% f.r. (f. reading) < 2,0x10^{-3} mbar: < factor 2 (f. reading)
Measuring Rate	1,0 s
Logging Rate	1 … 6000 s
Operating Temperature	+5...+50 °C
Storage Temperature	-20...+60 °C
Power Supply	9V battery or 15VDC external
Electrical Connection	mini-jack 2,5mm for plug-in power supply
Power Consumption	approx. 110mW (clocked)
Operation Time	Li-battery: <100h, 6LR61 Alkaline:<40h
Serial Interface	Mini-USB, Type B, 5pin, female, Virtual Com Port protocol
Vacuum Connection	Small flange DN16 ISO KF
Display	LCD 12mm
Protection Class	IP 40
Weight	230g (incl. battery)

Declaration of Conformity

oerlikon
leybold vacuum

CE

EC Declaration of Conformity

We, Oerlikon Leybold Vacuum GmbH, hereby declare that the products specified and listed below which we have placed on the market, comply with the applicable EC Council Directives.

This declaration becomes invalid if modifications are made to the product without agreement of Oerlikon Leybold Vacuum GmbH.

Compliance with the EMC Directives requires that the components are installed within a system or machine in a manner adapted to EMC requirements.

Designation of the product:	TM 101
Type:	Compact Vacuum Meter
Part-No.:	230081V01

The product complies to the following European Council Directives:

- Directive 2004/108/EC relating to electromagnetic compatibility

Related, harmonized standard:

• EN 61326-1	Electrical equipment for measurement, control and laboratory use – (EMC) requirements - Part 1: General requirements