

# Vacuum Measurement

User-optimized Active Gauges for Various Applications from 2000 mbar to  $10^{-10}$  mbar



	Measurement Principle	Range [mbar]																GRAPHIX	GRAPHIX	GRAPHIX	DISPLAY	DISPLAY	DISPLAY	
		2000	1000	100	10	1	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-7</sup>	10 <sup>-8</sup>	10 <sup>-9</sup>	10 <sup>-10</sup>	10 <sup>-11</sup>	10 <sup>-12</sup>						
<b>Direct Gauges</b>	Capacitive / piezo	DI/DU 200 / 2000 / 2001 series																						
		DI/DU 2001 rel.																						
	Capacitive	CERAVAC CTR 100 N series																						
		CERAVAC CTR 101 N series																						
<b>Indirect Gauges</b>	Thermal conductive (Pirani)	THERMOVAC TTR 91N / 96 N series																						
		THERMOVAC TTR 101N / 200 N series																						
	Cold cathode ionization (Penning)	PENNINGVAC PTR 225 N / 237 N																						
	Pirani and cold cathode ionization	PENNINGVAC PTR 90 N / 200 N series																						

# The ideal vacuum gauge for your requirements

Application	Sensors:	CERAVAC CTR	Linear pressure sensors DI/DU	THERMOVAC TTR	PENNINGVAC PTR	IONIVAC ITR
Research and Development		■		■	■	
Chemical/Chemistry processes		■	■	■	■	
Heat Treatment/Metallurgy		■	■	■	■	■
Automotive Industry		■	■	■	■	
Space Simulation		■	■	■	■	■
Analytical		■	■	■	■	■
Refrigeration and Air conditioning			■	■		
Chemistry and Research laboratories		■	■	■	■	■
High vacuum pump systems		■		■	■	■
Mechanical Engineering		■	■	■	■	■
Sputter Systems		■	■	■	■	■
Process Industry		■	■	■	■	■
Solar		■	■	■		

For further application examples, please refer to our full line catalog, chapter "vacuum - measuring, controlling".

## Oerlikon Leybold Vacuum transmitters are specially suited for system integration

Our high-precision vacuum sensors meet your demands:

- Highly reliable fore vacuum pressure measurement
- Simple operation
- Highly reproducible measurement results
- Several measurement locations to be constantly monitored
- Simple, cost and space saving installation
- Direct data transfer to PLC/computer via digital/analog interface
- Increased transmission distances (up to 100 m) between measurement location and processing station
- Increased electromagnetic compatibility (EMC) requirements
- Compliance with international standards and regulations (CE, RoHS, WEEE etc.)

# Active Sensors / Vacuum Transmitters

## Capacitance Diaphragm Gauges (CDG)



### CERAVAC Transmitters

#### CTR 100 N / CTR 101 N

The CERAVAC transmitters are suited for corrosive process gases.

#### Benefits

- New sensing cell: the new all-welded Inconel® sensor is extremely robust
- Microprocessor-based electronics for excellent accuracy and reproducibility
- Long-term stability: no calibration shifts after bursts of pressure

#### Principle of measurement

Capacitive diaphragm stainless steel sensor

#### Measurement/display range

Spanning from  $10^{-5}$  to 1000 Torr, depending on the model

### Linear Pressure Sensors

#### DI/DU 200/201, DI/DU 2000/2001, DI/DU 2001 rel.

These sensors excel through a high overload response as well as excellent corrosion and vibration resistance.

#### Benefits

- Wide measurement range due to the combined measurement principle
- Very compact: just one sensor needed
- Two-in-one sensor: cost and space saving solution

#### Principle of measurement

Capacitive ceramic diaphragm sensor, piezo resistive diaphragm sensor

#### Measurement/display range

Absolute pressure measurement: 0.1 to 200 mbar or 1 to 2000 mbar

## Thermal Conductivity Gauges (Pirani)



### THERMOVAC Transmitters

Operation of the THERMOVAC transmitters is based on the thermal conductivity principle after Pirani. S-versions offer set point relays for improved process control.

The THERMOVAC series is equipped with a LED-ring (360°) showing the sensor status.

#### Benefits

- New MEMS-Pirani for high resistance
- Fast response and high accuracy: time saving and highly reliable
- Optimized price-to-performance ratio

#### TTR 91 N(S) / TTR 96 N

#### Principle of measurement

Thermal conductivity after Pirani

#### Measurement/display range

$5 \cdot 10^{-5}$  to 1000 mbar

#### TTR 911 N(C/S) / TTR 916 N

The TTR 911 and TTR 916 have a touch display and/or digital interfaces.

C-versions are equipped with a Parylene HT®-coated sensor for chemical and aggressive applications.

#### Principle of measurement

Thermal conductivity after Pirani

#### Measurement/display range

$5 \cdot 10^{-5}$  to 1000 mbar

#### TTR 101 N(S)

The THERMOVAC TTR 101 N models use a thermal conductivity MEMS Pirani / Piezo solid state sensor combination. They are resilient to vibration and shock venting and provide superior accuracy and gas type independent readings between 10 mbar and 1500 mbar.

#### Benefits

- Two-in-one sensor: cost and space saving measurement solution
- Large measurement range and time-saving measurements

#### Principle of measurement

Thermal conductivity after Pirani combined with Piezo

#### Measurement/display range

$5 \cdot 10^{-5}$  to 1500 mbar



# High endurance - accurate and reproducible results

## Cold Cathode Ionization Gauges



## Multiple combination Gauges



## Hot Cathode Ionization Gauges



## PENNINGVAC Transmitters

### PTR 90 N

These PENNINGVAC transmitters are the perfect gauge for a wide range of applications.

#### Benefits

- New MEMS-Pirani / cold cathode combination for cost and time-saving measurements
- Complete coverage of the measurement range from  $1 \times 10^{-8}$  mbar to atmosphere by a single transmitter
- Automatic ignition of the cold cathode by the MEMS-Pirani: ease of use and high process stability
- Modular design for easy servability

#### Principle of measurement

Cold cathode ionization after Penning combined with thermal conductivity (MEMS Pirani)

#### Measurement/display range

$1 \cdot 10^{-8}$  to 1000 mbar

### PTR 225 N / PTR 237 N

Easy system integration, providing excellent process control even in rough applications.

#### Benefits

- Robust cold cathode sensing cell: reliable measurements and high process quality
- Modular design provides low TCO by easy and inexpensive servicing

#### Principle of measurement

Cold cathode ionization after Penning

#### Measurement/display range

$1 \cdot 10^{-8}$  to  $5 \cdot 10^{-3}$  mbar

## LoadLock Transmitters

### TTR 200 N

### PTR 200 N

The TTR 200 N and PTR 200 N combine different measurement technologies in one housing making them the perfect gauges for load lock applications.

#### Benefits

- Combination of absolute and differential measurements offers unprecedented loadlock control
- Differential range (relative to ambient pressure): -1013 to 1013 mbar
- The highly accurate differential sensor is ideal for loadlock control since it is insensitive to changes in ambient pressure conditions
- Efficient loadlock control improves throughput and cycle time

#### Principle of measurement

Up to three sensors in one housing for a wide measurement range

#### Measurement/display range

TTR 200:  $5 \cdot 10^{-5}$  mbar to 1500 mbar  
PTR 200:  $1 \cdot 10^{-8}$  mbar to 1500 mbar

Gas type independent pressure measurements from 50 mbar to 1300 mbar

## IONIVAC Transmitters

### ITR 90 / ITR 90 PB

### ITR 200 S / ITR 200 SP

The IONIVAC units permit, by way of combined hot cathode ionization meters with a Pirani sensor, vacuum pressure measurements on non-combustible gases and gas mixtures within a wide range of pressures.

Optionally, the pressure can be displayed on an integrated display.

#### Benefits

- The Pirani / hot cathode ionization (Bayard-Alpert) combination allows continuous pressure measurements
- Just one gauge required to cover a wide measurement range
- Cost- and space-saving solution
- The integrated dual Pirani provides a long service life

#### Principle of measurement

Hot cathode ionization vacuum gauges after Bayard-Alpert combined with thermal conductivity after Pirani

#### Measurement/display range

$5 \cdot 10^{-10}$  to 1000 mbar

# High Precision Vacuum Measurements

Technical Data		CERAVAC		Linear pressure sensors		
Vakuum Transmitter		CTR 100 N	CTR 101 N	DI / DU 200 / 201	DI / DU 2000/2001/2001 rel.	TTR 91 N(S) TTR 96 N
Principle of measurement		Capacitance diaphragm Stainless steel sensor	Capacitance diaphragm Stainless steel sensor	Capacitive ceramic diaphragm sensor	Piezo resistive ceramic diaphragm	TTR 91 N(S): MEMS-Pirani TTR 96 N: Coated MEMS-Pirani
Measurement range / Display range	mbar	1000 / $1 \cdot 10^{-1}$ Torr* 100 / $1 \cdot 10^{-2}$ Torr 20 / $2 \cdot 10^{-3}$ Torr 10 / $1 \cdot 10^{-3}$ Torr 1 / $1 \cdot 10^{-4}$ Torr 0.1 / $1 \cdot 10^{-5}$ Torr	1000 / $1 \cdot 10^{-1}$ Torr* 100 / $1 \cdot 10^{-2}$ Torr – 10 / $1 \cdot 10^{-3}$ Torr 1 / $1 \cdot 10^{-4}$ Torr 0.1 / $1 \cdot 10^{-5}$ Torr	0.1 to 200	1 to 2000  DI/DU 2001 rel.: -1000 to +1000 relative pressure	$5 \cdot 10^{-5}$ - 1000
Measurement uncertainty	mbar	0.2% of reading ± temperature effect  0.5% of reading ± temperature effect (0.1 Torr)	0.12% of reading ± temperature effect  0.15% of reading ± temperature effect (0.1 Torr)	0.25 % of full scale linearity, reproducibility and hysteresis		$5 \cdot 10^{-4}$ to $1 \cdot 10^{-3}$ ±10 % of reading  $1 \cdot 10^{-3}$ to 100 ±5 % of reading  100 to atm ±25 % of reading
Status indicators		LED		–		LED-ring (360°)
Max. bakeout temperature	°C	Not bakeable		70		85, non-operating
Overpressure limit	bar			6	5	6
Protection class	IP	40		54		40
Setpoints		0	0	–	–	0 at TTR 91 N 2 at TTR 91 NS 2 at TTR 96 N
Max. cable length Electrical connection	m	30 (type C) Sub-D, 15 pin		25 DI: 7 pole diode plug (5 m) / DU: FCC 68 (5 m)		100 (type A) FCC 68 / RJ45
Interfaces		RS 232		DI: 4 - 20 mA / DU: 2 - 10 V		– –
Controller type		GRAPHIX series		DI: GRAPHIX and DISPLAY series via signal converter DU: DISPLAY and GRAPHIX series		DISPLAY and GRAPHIX series

from 2000 mbar to  $10^{-10}$  mbar

THERMOVAC		PENNINGVAC		Loadlock Combinations		IONIVAC	
TTR 911 N(C/S) TTR 916 N	TTR 101 N(S)	PTR 90 N	PTR 225 N PTR 237 N	TTR 200 N	PTR 200 N	ITR 90	ITR 200 S
TR 911 N: MEMS-Pirani TR 911 N/C / TTR 916 N: coated MEMS-Pirani	MEMS-Pirani and Piezo	Cold cathode according to Penning and MEMS Pirani	Cold cathode according to Penning	MEMS-Pirani and Diff. Piezo	Cold cathode, MEMS-Pirani and Diff. Piezo	Bayard-Alpert and Pirani	
$10^{-5}$ - 1000	$5 \cdot 10^{-5}$ - 1500	$1 \cdot 10^{-8}$ - 1000	$1 \cdot 10^{-8}$ - $5 \cdot 10^{-3}$	absolute: $5 \cdot 10^{-5}$ - 1500 ** differential [RS 232]: -1013 to 1013	absolute: $1 \cdot 10^{-8}$ - 1500 ** differential [RS 232]: -1013 to 1013	$5 \cdot 10^{-10}$ - 1000	
$10^{-4}$ to $1 \cdot 10^{-3}$ 10 % of reading $10^{-3}$ to 100 $\pm 5$ % of reading 100 to atm $\pm 25$ % of reading	$5 \cdot 10^{-4}$ to $1 \cdot 10^{-3}$ $\pm 10$ % of reading ** $1 \cdot 10^{-3}$ to 11 $\pm 5$ % of reading ** 11 to 1333 $\pm 0.75$ % of reading **	$1 \cdot 10^{-4}$ to $1 \cdot 10^{-3}$ $\pm 10$ % of reading ** $1 \cdot 10^{-3}$ to 100 $\pm 5$ % of reading ** 100 to 1000 $\pm 25$ % of reading ** $1 \cdot 10^{-8}$ to $1 \cdot 10^{-3}$ $\pm 30$ % of reading **	$\pm 30$ % at $1 \cdot 10^{-8}$ to $1 \cdot 10^{-3}$ mbar	MEMS-Pirani: $1 \cdot 10^{-4}$ to $1 \cdot 10^{-3}$ $\pm 10$ % of reading ** Diff. Piezo: -10 to 10 $\pm 10$ % of reading $\pm 0.67$ mbar **	Cold cathode: $1 \cdot 10^{-8}$ to $1 \cdot 10^{-3}$ $\pm 30$ % of reading ** MEMS-Pirani: $1 \cdot 10^{-4}$ to $1 \cdot 10^{-3}$ $\pm 10$ % of reading ** Diff. Piezo: -10 to 10 $\pm 10$ % of reading $\pm 0.67$ mbar **	15% at $1 \cdot 10^{-8}$ - $1 \cdot 10^{-2}$ mbar > 15% at $10^{-1}$ - 1000 mbar	
LED-ring (360°)	LED-ring (360°)	LED-ring (360°)		LED-ring (360°)	LED-ring (360°)	–	
85, non-operating	85, non-operating	85, non-operating		85, non-operating	85, non-operating	150 with bake-out extension	80
	2	2		2	2	2	
40	40	40		40	40	30	
[Profibus / EtherCAT / Display] 3 [RS 232]	2 3 [RS 232]	0 3 (RS 232)	0 3 (RS 232) 2 (EtherCAT)	3	3	–	1 - 2
100 (type A) FCC 68 / RJ45	100 (type A) 1 x FCC 68 or 2 x FCC 68 + 1 x Sub-D 15 pin	100 (type A) FCC 68 / RJ 45	100 (type A) FCC 68 / RJ 45 EtherCat: RS 232	20 (type A) Sub-D 15 pin	20 (type A) Sub-D 15 pin	100 (type C) Sub-D, 15-way male	
TR 911 N Display: – TR 911 N S: RS 232 TR 911 N/C: EtherCAT/Profibus TR 916 N Display: –	RS 232 / Display / EtherCAT / Profibus	RS 232 EtherCAT	RS 232 EtherCAT	RS 232	RS 232	RS 232 C Profibus	
DISPLAY and GRAPHIX series	DISPLAY and GRAPHIX series	DISPLAY and GRAPHIX series	DISPLAY TWO DISPLAY THREE GRAPHIX series			GRAPHIX series	

# Display and Operating Instruments

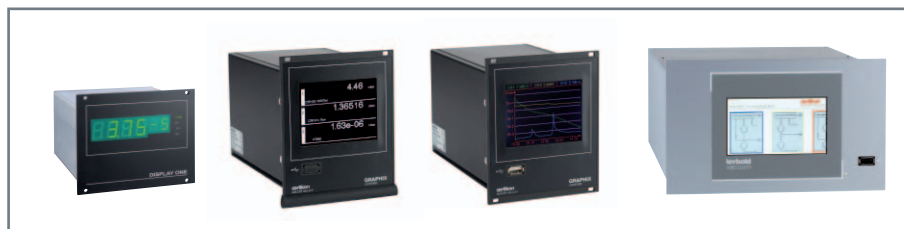
A number of different display and operating units is available for the active sensors from Oerlikon Leybold Vacuum.

- **DISPLAY** series  
Single and multichannel instruments
- **GRAPHIX** series  
Single and multichannel instruments
- **VACVISION**  
Universal vacuum controller

All these display and operating units display the measured values and supply the operating voltage. They may be operated either as a bench top unit or within 19" racks.

The new GRAPHIX series comprises vacuum controllers with up to three measurement channels.

GRAPHIX monitors and controls the entire vacuum process of active sensors for direct pressure measurements ( $10^{-10}$  mbar to 2000 mbar).



DISPLAY ONE, DISPLAY THREE, GRAPHIX THREE and VACVISION

## Display and Operating Instruments

for active sensors	P/N	CTR	DI <sup>1)</sup> DU	ITR	TTR	PTR 90 N	PTR 225/237 N
Single/multichannel instruments							
DISPLAY ONE	230 001	—	✓	—	✓	✓	—
DISPLAY TWO	230 024	—	✓	—	✓	✓	✓
DISPLAY THREE	230 025	—	✓	—	✓	✓	✓
GRAPHIX ONE	230680V01	✓	✓	✓	✓	✓	✓
GRAPHIX TWO	230681V01	✓	✓	✓	✓	✓	✓
GRAPHIX THREE	230682V01	✓	✓	✓	✓	✓	✓
VACVISION vacuum controller	230400V01	✓	—	✓	✓	✓	—

Typification of the Connection Lines	DISPLAY ONE	DISPLAY TWO DISPLAY THREE	GRAPHIX ONE GRAPHIX TWO GRAPHIX THREE
<b>Display and operating unit</b>			
THERMOVAC transmitter TTR series	Type A	Type A	Type A
PENNINGVAC transmitter PTR series	Type A	Type A	Type A
CERAVAC transmitter CTR series (digital signal)	—	—	Type C
Linear pressure sensors DU 200/1 and DU 2000/1/rel	Type A*	Type A*	Type A*
Linear pressure sensors DI 200/1 and DI 2000/1/rel (with signal converter)	Type A** <sup>1)</sup>	Type A** <sup>1)</sup>	Type A** <sup>1)</sup>
IONIVAC transmitter ITR series	—	—	Type C
<b>Type A:</b> FCC 68 (RJ 45) at both ends, eight-way shielded / <b>Type A*:</b> Preconnected measuring cable (5 m) with FCC 68 (RJ 45), eight-way shielded <b>Type A**:</b> Preconnected measuring cable (5 m) with diode plug, 7-pole. <sup>1)</sup> Operation requires the use of a signal converter <b>Type C:</b> Sub-D, 15-way female to Sub-D 15-way male, shielded			

For more detailed information, please refer to the Oerlikon Leybold Vacuum full line catalog, chapter "vacuum - measuring, controlling".



## Headquarter Germany

Oerlikon Leybold Vacuum GmbH  
Bonner Strasse 498  
D-50968 Köln

T +49 (0) 221-347-0  
F +49 (0) 221-347-1250

