

Products

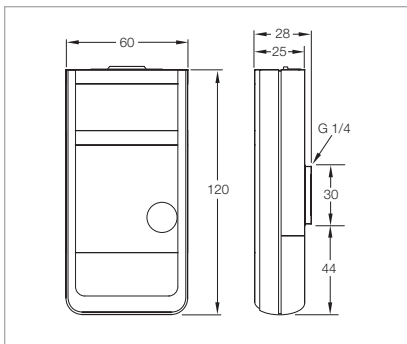
Handheld Measuring Instruments

Digital PIEZOVAC Sensor PV 101

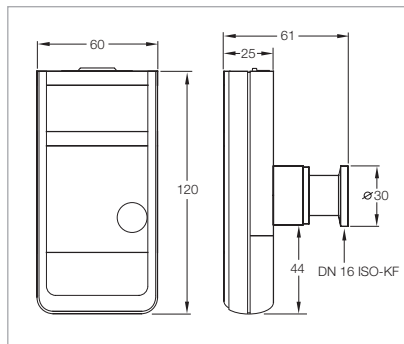
Digital THERMOVAC Sensor TM 101



PIEZOVAC Sensor PV 101 (left) and THERMOVAC Sensor TM 101 (right)



Dimensional drawings PIEZOVAC PV 101 (mm)



Dimensional drawings THERMOVAC TM 101 (mm)

The **PIEZOVAC PV 101** has been specially developed for food sector deployments. The device can be operated directly under vacuum conditions. Thanks to its detachable flange connection the size of the sensor was significantly reduced. In the medium vacuum range pressures of up to 0.1 mbar will be traced and read out. The exclusive use of its piezo sensor significantly increases the battery's service life so that the device is continuously ready for operation. With a measuring rate of minimum 50 ms, you are informed in short process times on the current pressure.

The **THERMOVAC TM 101** is the essential device for on-site service calls. Thanks to the easy use and integrated measurement data memory, pressures can be directly measured at different locations for monitoring the application. Owing to the advanced

measuring range of the high-precision Pirani sensor, pressures of up to 5×10^{-4} mbar can be displayed.

Advantages to the User

- Direct display of measuring values; other monitoring devices are not necessary
- Developed for deployments in demanding environments
- Versatile deployment due to mains-independent power supply
- High-precision measurements of all common gas types
- Export and analysis of stored measurement values via USB interface
- Online analysis of measurement values via USB interface

The digital compact PIEZOVAC PV 101 and THERMOVAC TM 101 combine high-quality sensor technology with modern processor technology in a handy design.

Owing to their battery mode, the devices can be attached and operated at any pressure measuring point, and directly display or store up to 2,000 values for later evaluations and visualizations. All data values stored can be exported and displayed on a computer via USB link and by means of the optional VacuGraph software. The software is especially useful for setting up the devices or calculating rises in pressure for detecting rough leaks.

A carrying case providing space for all required accessories and for storing and transport protection is enclosed with the device and the software.

Typical Applications

- Versatile deployment with vacuum pump and vacuum plant servicing
- Comparative measurements of fixed pressure gauges
- Direct measuring inside vacuum vessels or vacuum packs
- Measuring of rough leaks after maintenance services

Technical Data

PIEZO VAC Sensor

PV 101

THERMOVAC Sensor

TM 101

Measurement principle		Piezo-resistive	Piezo-resistive (gas type independent) and thermal conductance Pirani
Indicated units of measurement		mbar, Torr, microns, hPa	mbar, Torr, microns, hPa
Measurement range	mbar (Torr)	1200 to 0,1 (900 to 0,075)	1200 to 5×10^{-4} (900 to 3.75×10^{-4})
Maximum overload	bar abs.	2	2
Maximum overload			
1200 – 10 mbar (900 to 75 Torr)		±0,3 % of full-scale	±0,3 % of full-scale
10 – 2×10^{-3} mbar		-	10 % of measured value
(7.5 to 1.5×10^{-3} Torr)		-	< factor 2 of measured value
$< 2 \times 10^{-3}$ mbar			
($< 1.5 \times 10^{-3}$ Torr)			
Gas type correction factor		Ar, CO ₂ , He, CO, H ₂ , N ₂ , Kr	Ar, CO ₂ , He, CO, H ₂ , N ₂ , Kr
Materials in contact with the vacuum		Stainless steel 1.4305, Viton®, silicon gel	Stainless steel, gold, tungsten, nickel, glass, Viton
Measurement cycle	s	0,1 (50 ms, from 2018 series)	1.0
Data storing rate	s	0.1 to 6000	1 to 6000
Operating temperature			
Sensor	°C	+5 to +50	+5 to +50
Battery	°C	-20 to +45	-20 to +45
Storage temperature			
Sensor	°C	-20 to +60	-20 to +60
Battery	°C	+10 to +25	+10 to +25
Supply voltage		Rechargeable 9 V battery (recommendation: type Panasonic 6LR61PM, 9 V / 500 mAh) or 12 – 15 V DC external adaptor (miniature jack, + terminal at the tip)	Rechargeable 9 V battery (recommendation: type Panasonic 6LR61PM, 9 V / 500 mAh) or 12 – 15 V DC external adaptor (miniature jack, + terminal at the tip)
Power consumption			
< 200 mbar (< 150 Torr)	mW	2	60
> 200 mbar (> 150 Torr)	mW	2	2
Operating duration			
6LR61 alkaline (vacuum operation)	h	< 2500	up to 75
Display		LCD 12 mm	LCD 12 mm
Connection (stainless steel)		G 1/4 internal thread (DN 16 ISO-KF with adaptor, removable)	DN 16 ISO-KF
PC interface		Mini USB-B connector	Mini USB-B connector
Dimensions	mm	60 x 120 x 50 (DN 10 ISO-KF)	60 x 120 x 61
	mm	60 x 120 x 28 (G 1/4)	
Protection class	IP	40	40
Weight (including battery)	kg (lbs)	0.2 (0.44)	0.23 (0.51)

Ordering Information

PIEZO VAC Sensor

PV 101

THERMOVAC Sensor

TM 101

	Part No.	Part No.
Sensor	230 080 V01	230 081 V01
Including AIMn battery, 9 V block 6LR 61		
Accessory kit for VacuGraph Windows software including	230 082 V01	230 082 V01
USB interface cable (2 m)		
protection case with foam insert and 15 V wall power supply for 100 – 260 V, 50/60 Hz mains and AIMn battery, 9 V block 6LR 61		

THERMOVAC-Transmitter

TTR 91 N (S), TTR 96 N, TTR 911 N (C), TTR 916 N



THERMOVAC Transmitter TTR N analog (left); digital RS232 (middle), with Display (right)

The THERMOVAC Transmitters are active sensors using the unique MEMS-Pirani technology (Micro-Electro-Mechanical-Systems). They offer analog voltage output and the S-versions offer set point relays for improved process control. For chemical and aggressive applications, the C-versions are equipped with a Parylene HT®-coated sensor. The THERMOVAC series is also equipped with a LED-ring (360°) showing the status of the sensor.

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

Advantages to the User

- Very robust MEMS-Pirani solid state sensor resilient to vibration and shock venting
- Extended measuring range up to 5×10^{-5} mbar and significantly higher accuracy compared to conventional sensors
- Reduced response times because of significantly improved signal processing
- High accuracy
- Individually temperature compensated to ensure stable measurements
- High reproducibility
- Measurement signal insensitive to mounting position
- Robust stainless steel housing
- Available with display for pressure units, set point parameters and operation status
- Available with up to three set point relays for improved process control
- Optional Computer interfaces: EtherCAT and RS 232
- Long tube version for reaching higher chamber bakeout temperatures
- LED ring to indicate status of the sensor

Typical Applications

The THERMOVAC Transmitters offer a high degree of versatility. They are suited for applications in the medium and rough vacuum range.

Typical applications are:

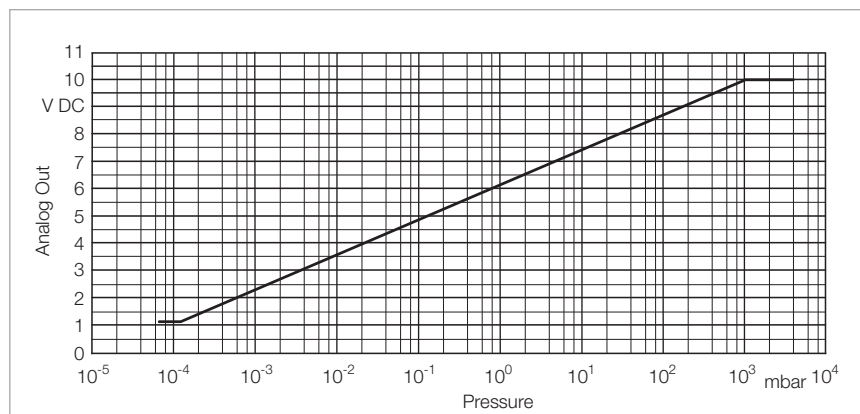
- Analytical instrumentation
- Research and development
- Vacuum Drying
- Controlling of ionization gauges
- Activation of UHV gauges
- System process control
- Process industry
- Coated versions for improved chemical resistance
- General foreline vacuum measurement

Sensor

The THERMOVAC transmitters' measurement principle is based on thermal conductivity. The transmitters are equipped with a MEMS-Pirani sensing cell that consists of a silicon chip with a heated resistive element.

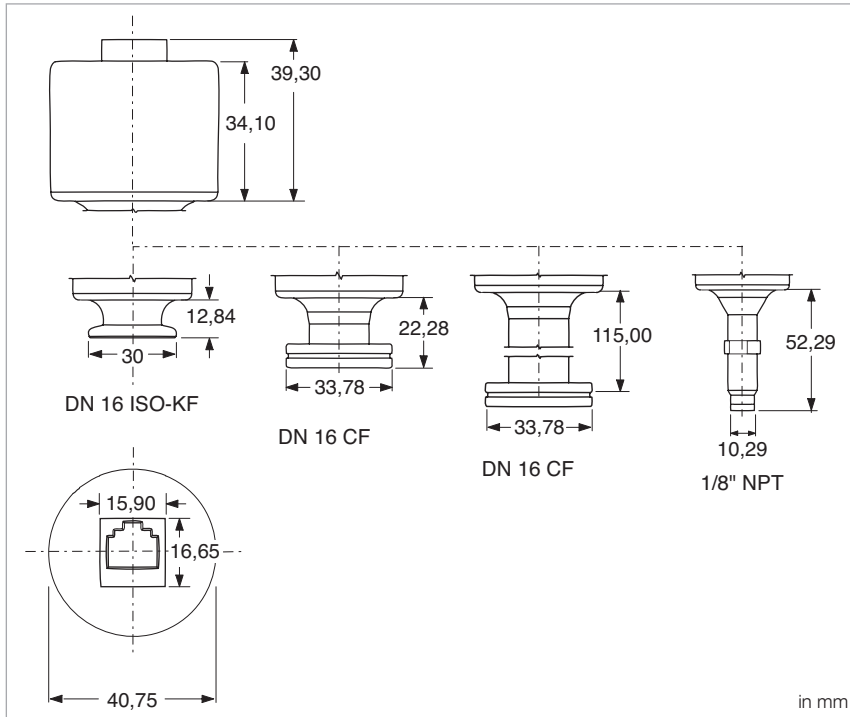
The THERMOVAC transmitters with the coated MEMS-Pirani are well suited for harsh processes and therefore more robust than the uncoated versions. Built-in relays allow switching functions to be performed directly by the transmitter, without the need of a programmable control.

An integration of the transmitters in programmable control systems is facilitated by the linear characteristic, which can be defined by entering a simple equation into a PLC or computer.

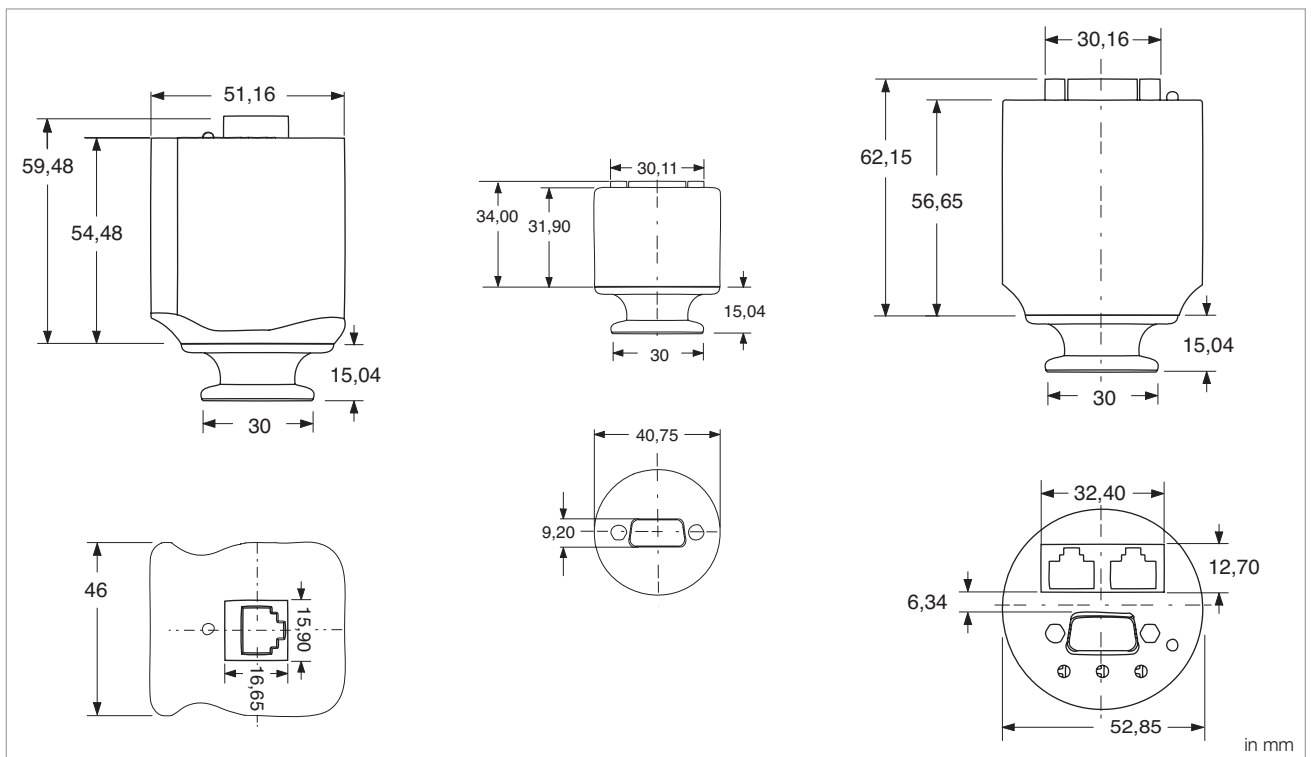


Characteristic of the THERMOVAC Transmitters TTR 91 N (S) / TTR 96 N and TTR 911 N (C) / TTR 916 N

Parylene HT® is a registered trademark of Speciality Coating Systems Inc.



Dimensional drawings for the THERMOVAC Transmitters TTR 91 N (S) / TTR 96 N
 (Middle left – DN 16 CF standard version, middle right backable with elongated flange)



Dimensional drawings for the THERMOVAC Transmitters TTR 911 N (C) / TTR 916 N
 left: with display, middle: with RS 232, right: with EtherCAT

Technical Data

THERMOVAC Transmitter TTR 91 N TTR 91 N S TTR 96 N S

Measurement range	mbar (Torr)	5.0 x 10 ⁻⁵ to Atmosphere (3.75 x 10 ⁻⁵ to Atmosphere)		
Measurement uncertainty of reading (typical) ¹⁾	mbar	5 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 100 ±5 % 100 to atm ±25 %		
Repeatability of reading (typical) ¹⁾	mbar	1 x 10 ⁻³ to 100 ±2 %		
Sensor		MEMS-Pirani	MEMS-Pirani	Coated MEMS-Pirani
Measurement principle		Thermal conductivity according to Pirani		
Supply voltage	V DC	9 – 30		
Power consumption	W	< 1.2		
Electrical connection		FCC 68, RJ45 (analog) / Sub-D 15 PIN (digital)		
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 0.61 to 10		
Resolution	bit	16		
Impedance	Ω	100		
Update rate	Hz	16		
Interfaces		FCC 68, RJ45 (analog) / RS232, EtherCAT, Profibus (digital)		
Set point				
Range	mbar (Torr)		2.7 x 10 ⁻⁴ to 1000 (2.0 x 10 ⁻⁴ to 750)	
Relay		0	2	2
Relay contact rating		1 A at 30 V AC/ DC, resistive load		
Relay contact resistance, max.	mΩ	100		
Relay contact endurance, min.		100 000		
1.0 A at 30 V DC load		2 000 000		
0.2 A at 30 V DC load				
Status indicators		LED-ring (360°)		
Max. cable length	m	100		
Overpressure limit (abs.)	bar	6 (10 bar for inert gases)		
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)		
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)		
Max. bakeout temperature	°C (°F)	85 (185), non-operating [bakeable version up to 250 (482)]		
Max. rel. humidity	% n.c.	≤ 95		
Installation orientation		Any		
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®		304 stainless steel, Viton®, Parylene-HT®
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.80		
Weight (DN 16 ISO-KF)	g	170		
Protection class	IP	40		
CE certification		EMC Directive 2014/30/EEC		
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE		

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40 – 60 °C

Ordering Information

THERMOVAC Transmitter TTR 91 N (S) / TTR 96 N

	Part No.
Without switching threshold	
TTR 91 N, DN 16 ISO-KF	230035V02
TTR 91 N, 1/8" NPT	230038V02
TTR 91 N, DN 16 CF	230036V02
TTR 91 N, DN 16 CF, Flange extended bakeable up to 250 °C (482 °F)	230037V02
With switching threshold	
TTR 91 N, DN 16 ISO-KF, 2SP	230040V02
TTR 91 N, 1/8" NPT, 2SP	230043V02
TTR 96 N C, DN 16 ISO-KF, 2SP, Parylene coated	230045V02
TTR 96 NC, DN 16 CF, 2SP, Flange extended bakeable up to 250 °C (482 °F), Parylene coated	230047V02
Calibration	see chapter "Miscellaneous", para. "Leybold Calibration Service"
Operating Units	
DISPLAY ONE	230 001
DISPLAY TWO	230 024
DISPLAY THREE	230 025
GRAPHIX ONE	230680V01
GRAPHIX TWO	230681V01
GRAPHIX THREE	230682V01
Connection cable, FCC 68 on both ends ¹⁾	Type A
5 m	124 26
10 m	230 012
15 m	12427
20 m	12428
30 m	12429
50 m	12431
75 m	12432
100 m	12433
Optional accessories	
Spiral tube DN 16 ISO-KF	230082
Connection cable, RS 232 ¹⁾	Type G
5 m	230550V01
10 m	230551V01
15 m	230552V01
20 m	230553V01

¹⁾ See chapter "Connection cables for Active Sensors"

Technical Data

THERMOVAC Transmitter TTR 911 N (C/S) / TTR 916 N

Measurement range	mbar (Torr)	5.0 x 10 ⁻⁵ to Atmosphere (3.75 x 10 ⁻⁵ to Atmosphere) 1.0 x 10 ⁻⁵ to Atmosphere (0.75 x 10 ⁻⁵ to Atmosphere) [RS 232 / Display]
Measurement uncertainty of reading ¹⁾	mbar	5.0 x 10 ⁻⁴ to 1.0 x 10 ⁻³ ±10 % 1.0 x 10 ⁻³ to 100 ±5 % 100 to atm ±25 %
Repeatability of reading ¹⁾	mbar	1 x 10 ⁻³ to 100 ±2 %
Sensor		MEMS-Pirani
Measurement principle		Thermal conductivity according to Pirani
Supply voltage	V DC	9 - 30
Power consumption	W	< 1.2
Electrical connection		FCC 68, RJ45 (analog) / Sub-D 15 PIN (digital)
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 0.61 to 10
Resolution	bit	16
Impedance	Ω	100
Update rate	Hz	16
Interfaces		FCC 68, RJ 45 (analog) / RS 232, EtherCAT, Profibus (digital)
Set point Range	mbar (Torr)	1.0 x 10 ⁻⁴ to 1000 (0.75 x 10 ⁻⁵ to 750) 2.7 x 10 ⁻⁴ to 1000 (2.0 x 10 ⁻⁴ to 750) [RS 232 / Display]
Relay		2 [Profibus / Display] / 2 [RS 232]
Relay contact rating		1 A at 30 V AC/ DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min.		100 000
1.0 A at 30 V DC load		2 000 000
0.2 A at 30 V DC load		
Status indicators		LED-ring (360°)
Max. cable length	m	100
Overpressure limit (abs.)	bar	6 (10 bar for inert gases)
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature	°C (°F)	85 (185), non-operating
Max. rel. humidity	% n.c.	0 – 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®, Parylene-HT® (coated)
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.80
Weight (DN 16 ISO-KF, RS 232 w/o Display)	g	168
Protection class	IP	40
CE certification		EMC Directive 2014/30/EEC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40 – 60 °C

Ordering Information

THERMOVAC Transmitter TTR 911 N (C/S) / TTR 916 N

	Part No.
TTR 911 N, DN 16 ISO-KF, EtherCAT	230700V02
TTR 911 N C, DN 16 ISO-KF, EtherCAT, Parylene coated	230701V02
TTR 911 N S, DN 16 ISO-KF, RS 232	89660V02
TTR 911 N, DN 16 ISO-KF, with display, FCC 68 / RJ 45	89654V02
TTR 916 N C, DN 16 ISO-KF, Parylene coated, FCC 68 / RJ 45	89656V02
Replacement sensor, DN 16 ISO-KF TTR 911 N, without Parylene coating	230650V02
TTR 916 N SC, TTR 911 NC, with Parylene coating	230651V02
Calibration	See Section "Miscellaneous", paragraph "Leybold calibration service"
Operating Units	
DISPLAY ONE	230 001
DISPLAY TWO	230 024
DISPLAY THREE	230 025
GRAPHIX ONE	230680V01
GRAPHIX TWO	230681V01
GRAPHIX THREE	230682V01
Connection cable, FCC 68 on both ends	Type A
5 m	124 26
10 m	230012
15 m	12427
20 m	12428
30 m	12429
50 m	12431
75 m	12432
100 m	12433
Optional accessories	
Spiral tube DN 16 ISO-KF	230 082
RS232 / USB Converter for setpoint definition of RS232 gauges	230399V02

THERMOVAC-Transmitter TTR 101 N (S)



THERMOVAC Transmitter TTR 101 N, analog (left), EtherCAT (middle), Display (right)

The THERMOVAC TTR 101 N models utilize a thermal conductivity MEMS-Pirani combined with a silicon membrane Piezo. They offer superior accuracy and gas type independent readings between 10 mbar and 1500 mbar.

Advantages to the User

- Wide measurement range combining two sensor technologies into a single output
- Extended measuring range up to 5×10^{-5} mbar and significantly higher accuracy compared to conventional sensors
- Robust MEMS-Pirani and Piezo solid state sensors resilient to vibration and shock venting
- Rapid cycling by fast and repeatable pressure measurements
- High reproducibility and high accuracy
- Gas type independent from 10 to 1500 mbar
- Autozero of Piezo
- Individually temperature compensated to ensure stable measurements
- Measurement signal insensitive to mounting position
- Available with display for pressure units, set point parameters and operation status
- Available with up to three set point relays for improved process control
- LED ring to indicate status of the sensor

Typical Applications

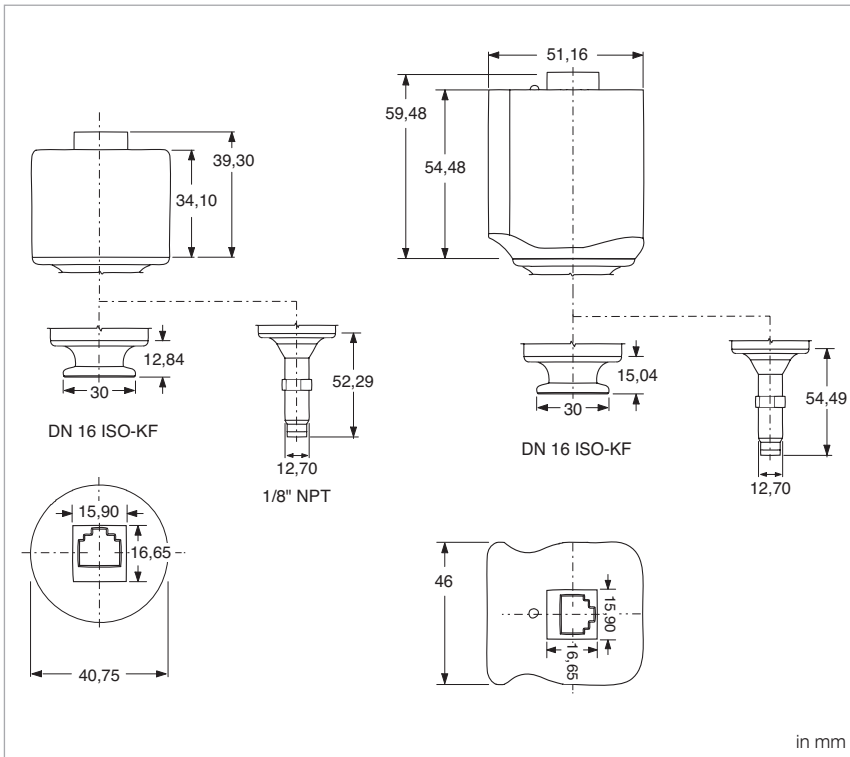
The THERMOVAC TTR 101 N transmitters can be used in any application that requires absolute pressure measurement and switching capabilities.

- General vacuum measurement and control from low to medium vacuum pressure
- Safety circuits in vacuum systems
- Control of high vacuum ionization gauges
- Analytical Instrumentation
- Research and development
- Vacuum Drying
- System process control
- Vacuum furnaces and sintering
- Coating
- Process industry

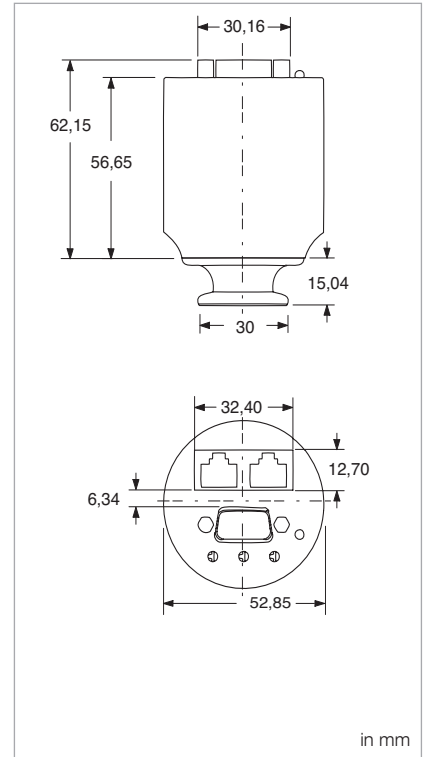
Sensor

Dust and other particles may cause measurement errors and reduced lifetime. Therefore we recommend the installation of a fine filter in critical applications.

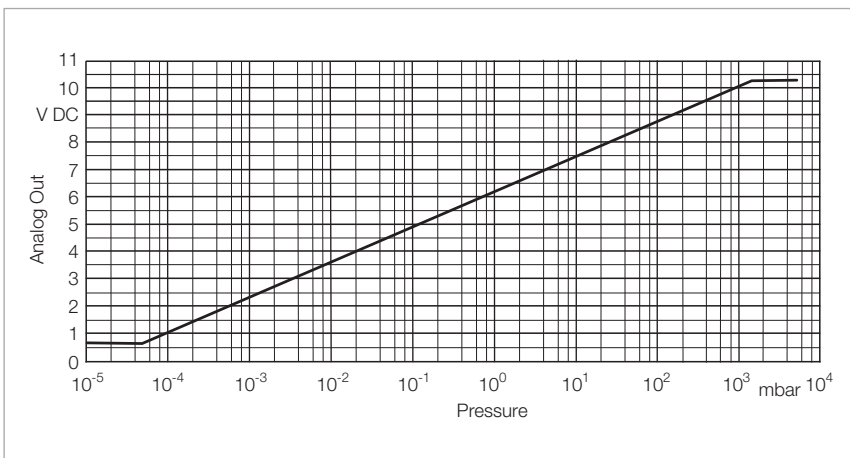
Fine filters are listed in chapter "General", para. "Connection Accessories for Small Flanges".



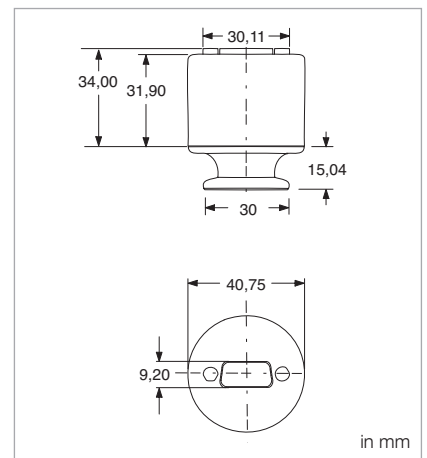
Dimensional drawing for the THERMOVAC Transmitters TTR 101 N (S) (left) and TTR 101 N Display (right)



Dimensional drawing for the TTR 101 N (EtherCAT)



Characteristic of the THERMOVAC Transmitters TTR 101 N (S)



Dimensional drawing for the TTR 101 N (RS 232)

Technical Data

THERMOVAC Transmitter TTR 101 N (S)

Measurement range	mbar (Torr)	5 x 10 ⁻⁵ to 1500 (3.75 x 10 ⁻⁵ to 1125) 1 x 10 ⁻⁵ to 2000 (0.75 x 10 ⁻⁵ to 1500) [RS 232 / Display / EtherCAT]
Measurement uncertainty of reading ¹⁾	mbar	5 x 10 ⁻⁴ to 1 x 10 ⁻³ ±10 % 1 x 10 ⁻³ to 10 ±5 % 11 to 1333 ±0.75 % 1333 to 2000 ±2 %
Repeatability of reading ¹⁾	mbar	5 x 10 ⁻⁴ to 10 ±2 % 11 to 1067 ±0.2 %
Sensor Measurement principle		MEMS-Pirani and Piezo
Supply voltage	V DC	9 – 30
Power consumption	W	< 1.2 [2 for EtherCAT]
Electrical connection		FCC 68, RJ 45 (analog) / Sub-D 15 PIN (digital)
Analog output	V DC	$V_{out} = \log_{10}(P_{mbar}) \times 1.286 + 6.143$ 0.61 to 10.23
Resolution	bit	16
Impedance	Ω	100
Update rate	Hz	16
Interfaces		FCC 68, RJ 45 (analog) / RS 232, EtherCAT, Profibus (digital)
Set point Range	mbar (Torr)	2.7 x 10 ⁻⁴ to 1000 (2.7 x 10 ⁻⁴ to 750) / 1.0 x 10 ⁻⁴ to 1000 (0.75 x 10 ⁻⁴ to 750)
Relay		2 / 3
Relay contact rating		1 A at 30 V AC / DC, resistive load
Relay contact resistance, max.	mΩ	100
Relay contact endurance, min. 1.0 A at 30 V DC load		100 000
0.2 A at 30 V DC load		2 000 000
Status indicators		LED-ring (360°)
Max. cable length	m	100
Overpressure limit (abs.)	bar	2
Operating temperature range ²⁾	°C (°F)	0 to 60 (32 to 140)
Storage temperature range	°C (°F)	-20 to +65 (-4 to 149)
Max. bakeout temperature	°C (°F)	85 (185), non-operating
Max. rel. humidity	% n.c.	0 – 95
Installation orientation		Any
Materials exposed to vacuum		304 stainless steel, Tin, Gold, Viton®
Dead volume (DN 16 ISO-KF), approx.	cm ³	2.8
Weight (DN 16 ISO-KF)	g	168
Protection class	IP	40
CE certification		EMC Directive 2014/30/EEC
Controller type		DISPLAY ONE / TWO / THREE and GRAPHIX ONE / TWO / THREE

¹⁾ Accuracy and repeatability are typical values measured with Nitrogen gas at ambient temperature after zero adjustment

²⁾ There may be minimal deviation tolerances in the range of 40 – 60 °C

Ordering Information

THERMOVAC Transmitter TTR 101 N (S)

	Part No.
TTR 101 N, DN 16 ISO-KF, FCC 68 / RJ 45	230350V02
TTR 101 N, 1/8" NPT, FCC 68 / RJ 45	230351V02
TTR 101 N, DN 16 ISO-KF, 2SP, FCC 68 / RJ 45	230352V02
TTR 101 N, 1/8" NPT, 2SP, FCC 68 / RJ 45	230353V02
TTR 101 N, DN 16 ISO-KF, Display, FCC 68 / RJ 45	230354V02
TTR 101 N, 1/8" NPT, Display	230355V02
TTR 101 N, DN 16 ISO-KF, Display, 2SP, FCC 68 / RJ 45	230356V02
TTR 101 N, DN 16 ISO-KF, 3SP, RS 232	230366V02
TTR 101 N, DN 16 ISO-KF, 2SP, EtherCAT	230702V02
Replacement sensor Flange DN 16 ISO-KF Flange 1/8" NPT	230361V02 230362V02
Centering ring with fine filter 16 ISO-KF	883 96
Calibration	See Section "Miscellaneous", paragraph "Leybold calibration service"
Operating Units DISPLAY ONE DISPLAY TWO DISPLAY THREE GRAPHIX ONE GRAPHIX TWO GRAPHIX THREE	230 001 230 024 230 025 230680V01 230681V01 230682V01
Connection cable, FCC 68 on both ends ¹⁾ 5 m 10 m 15 m 20 m 30 m 50 m 75 m 100 m	Type A 124 26 230012 12427 12428 12429 12431 12432 12433
Optional accessories Spiral tube DN 16 ISO-KF Connection cable, RS 232 ¹⁾ 5 m 10 m 15 m 20 m RS232 / USB Converter for setpoint definition of RS232 gauges	230 082 Type G 230550V01 230551V01 230552V01 230553V01 230399V02

¹⁾ See chapter "Connection cables for Active Sensors"