



Operating Manual (EN)

Multi-range Vacuum Sensor

Types:

- ▶ VMpro1
- ▶ VMpro2 Chem



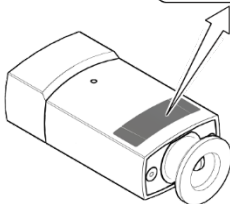
txna56e1

Revision: – 2020-11-12

Product Identification

In all communications with Gardner Denver Thomas GmbH, please specify the information given on the product nameplate. For convenient reference copy that information into the space provided below.

Gardner Denver Thomas GmbH, D-98693 Ilmenau	
Model:.....	CE
PN:.....	
SN:.....	QR
.....VW; LPS	



Validity

This document applies to products with part numbers

- 620096 (VMpro1, W filament)
- 620097 (VMpro2 Chem, Ni filament)

The part number (PN) can be taken from the product nameplate. We reserve the right to make technical changes without prior notice.

Intended Use

The gauges of the VMpro series have been designed for vacuum measurement of gases in the pressure range of 5×10^{-5} ... 1500 mbar.

General

They must not be used for measuring flammable or combustible gases in mixtures containing oxidants (e.g. atmospheric oxygen) within the explosion range.

The gauges are intended for operation in connection with a suitable power supply or with a suitable controller.

Function

The VMpro gauge is a combination gauge consisting of a Pirani sensor and a diaphragm capacitive sensor. Both sensors are constantly active.

At low pressures, only the signal of the Pirani sensor is used for pressure measurement; at high pressures, only the signal of the diaphragm capacitive sensor. To determine the output signal in the intermediate range, both signals are used proportionally to the pressure.

Patents

EP 0689669 B1, 0689670 B1, 0658755 B1


US Patents 5608168, 4031997, 5583297

Scope of Delivery

Part number set	Consisting off
600092	620096 1× gauge VMpro1 1× pin for adjusting settings via buttons 1× Operating Manual German 1× Operating Manual English
	620096-02: 1× power supply VMpro1 & 2 Chem
600094	620097 1× gauge VMpro2 Chem 1× pin for adjusting settings via buttons 1× Operating Manual German 1× Operating Manual English
	620096-02: 1× power supply VMpro1 & 2 Chem

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For cross-references within this document, the symbol (→  XY) is used.

1 Safety

1.1 Symbols Used



DANGER

Information on preventing any kind of physical injury.



WARNING

Information on preventing extensive equipment and environmental damage.



Caution

Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.



Notice



Labeling

1.2 Personnel Qualifications



Skilled personnel

All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

1.3 General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.
Consider possible reactions with the product materials.
Consider possible reactions (e.g. explosion) of the process media due to the heat generated by the product.
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

1.4 Liability and Warranty

Gardner Denver Thomas assumes no liability and the warranty becomes null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the product documentation.

The end-user assumes the responsibility in conjunction with the process media used.

Gauge failures due to contamination or wear and tear, as well as expendable parts (e.g. filament) are not covered by the warranty.

2 Technical Data

Measurement range	5×10 ⁻⁵ ... 1500 mbar
Measurement principle	diaphragm capacitive sensor
10 mbar ... 1500 mbar	
1 ... 10 mbar	crossover range
5×10 ⁻⁵ ... 1 mbar	thermal conductance acc. to Pirani
Accuracy (N ₂)	
5×10 ⁻⁴ ... 1×10 ⁻³ mbar	±5% of reading
1×10 ⁻³ ... 100 mbar	±15% of reading
100 ... 950 mbar	±5% of reading
950 ... 1050 mbar	±2.5% of reading
Repeatability (N ₂)	
1×10 ⁻³ ... 1100 mbar	±2% of reading
<hr/>	
Output signal (measurement signal)	
Voltage range	0 ... +10.23 V
Measurement range	+0.61 ... +10.23 V
Error signal	0 V (default)
Voltage vs. pressure	1.286 V/decade, logarithmic
Output impedance	2 × 4.7 Ω, short circuit-proof
Load impedance	>10 kΩ
Response time	<30 ms
<hr/>	
Gauge identification	71.5 kΩ
HV adjustment	at <10 ⁻⁵ mbar
ATM adjustment	at >100 mbar
<hr/>	

Technical Data

Supply



DANGER

The gauge may only be connected to power supplies, instruments, or control devices that conform to the requirements of a grounded protective extra-low voltage and limited power source (LPS), Class 2. The connection to the gauge has to be fused.

Supply voltage at the gauge	Class 2 / LPS +15 ... +30 V (dc)
Ripple	$\leq 1 V_{pp}$
Power consumption	$\leq 2.5 W$
Fuse to be connected	1 AT
Electrical connection	FCC 68
Sensor cable	shielded 0.14 mm ² /conductor
Cable length	$\leq 100 m$
Grounding concept	→ "Electrical Connection"
Vacuum connection to signal common	connected via 10 k Ω
Materials exposed to vacuum	
Vacuum connection	stainless steel 1.4435
Filament	
620096 (VMpro1)	W
620097 (VMpro2 Chem)	Ni
Feedthrough	glass
Orifice	stainless steel
Diaphragm	ceramic
Further materials	Ni, NiFe, stainless steel 1.4301, SnAg

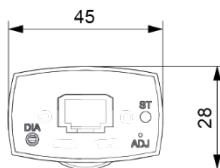
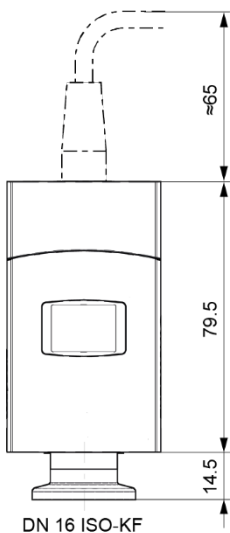
Technical Data

Internal volume	4.7 cm ³
Permissible pressure (absolute)	≤5 bar
Bursting pressure (absolute)	10 bar
Permissible temperatures	
Operation	+10 °C ... +50 °C
Vacuum connection ¹⁾	≤80 °C
Filament	<160 °C
Storage	-20 °C ... +65 °C
Relative humidity	
Year's mean	≤65% (no condensation)
During 60 days	≤85% (no condensation)
Mounting orientation	any
Use	indoors only, altitude up to 2000 m NN
Degree of protection	IP 40
Weight	<120 g

¹⁾ For horizontal mounting orientation only. During bakeout, measurement range, accuracy, and repeatability may deviate from specifications.

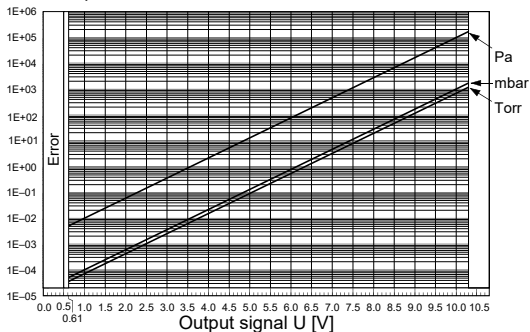
Technical Data

Dimensions [mm]



2.1 Output Signal vs. Pressure

Pressure p



$$p = 10^{0.778(U-c)}$$

↔

$$U = c + 1.286 \log_{10} p$$

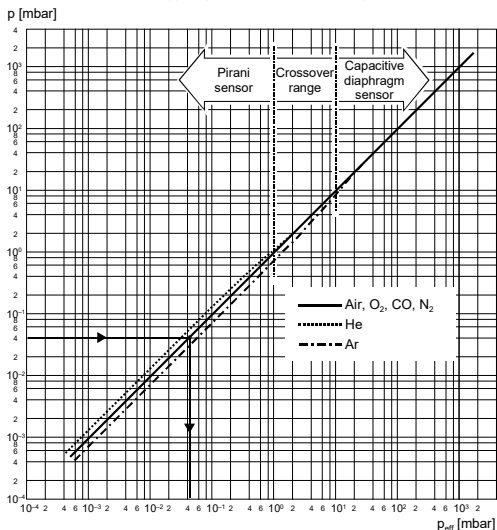
valid in the range 5×10^{-5} mbar $< p <$ 1500 mbar

U	p	c	U	p	c
[V]	[mbar]	6.143	[V]	[micron]	2.448
[V]	[μbar]	2.287	[V]	[Pa]	3.572
[V]	[Torr]	6.304	[V]	[kPa]	7.429
[V]	[mTorr]	2.448			

where p pressure
 U output signal
 c constant (pressure unit dependent)

2.2 Gas Type Dependence

Indicated pressure (gauge calibrated for air)



Calibration factors

valid for Pirani pressure range below 1 mbar

$$p_{\text{eff}} = C \times \text{indicated pressure}$$

Gas type	Calibration factor C	Gas type	Calibration factor C
He	0.8	H ₂	0.5
Ne	1.4	air, O ₂ , CO, N ₂	1.0
Ar	1.7	CO ₂	0.9
Kr	2.4	water vapor	0.5
Xe	3.0	Freon 12	0.7

3 Installation



WARNING



Fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.

3.1 Vacuum Connection



DANGER



Overpressure in the vacuum system >1 bar

Injury caused by released parts and harm caused by escaping process gases can result if clamps are opened while the vacuum system is pressurized.

Do not open any clamps while the vacuum system is pressurized. Use the type clamps which are suited to overpressure.



DANGER



Overpressure in the vacuum system >2.5 bar

KF flange connections with elastomer seals (e.g. O-rings) cannot withstand such pressures. Process media can thus leak and possibly damage your health.

Use O-rings provided with an outer centering ring.

Installation



DANGER



Protective ground

Products that are not correctly connected to ground can be extremely hazardous in the event of a fault.

Electrically connect the gauge to the grounded vacuum chamber. This connection must conform to the requirements of a protective connection according to EN 61010:

- For gauges with a KF flange, use a conductive metallic clamping ring.



Caution



Vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.



Caution



Dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

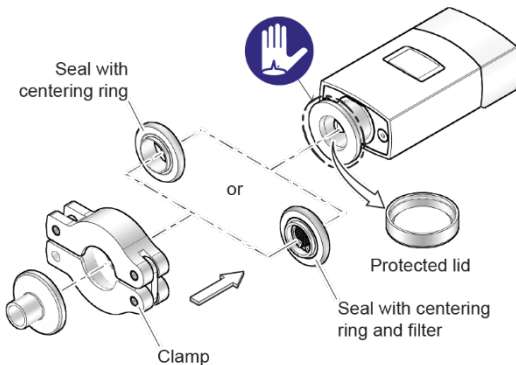
Always wear clean, lint-free gloves and use clean tools when working in this area.

Installation



Mount the gauge so that no vibrations occur. The gauge may be mounted in any orientation. To keep condensates and particles from getting into the measuring chamber preferably choose a horizontal to upright position and consider using a seal with centering ring and filter. If adjustment should be possible after the gauge has been installed, be sure to install it so that the buttons can be accessed with a pin.


Remove the protective lid and connect the product to the vacuum system.



Keep the protective lid.

3.2 Electrical Connection



Make sure the vacuum connection is properly made (→  13).



DANGER

The gauge may only be connected to power supplies, instruments or control devices that conform to the requirements of a grounded protective extra-low voltage and limited power source (LPS), Class 2. The connection to the gauge has to be fused.

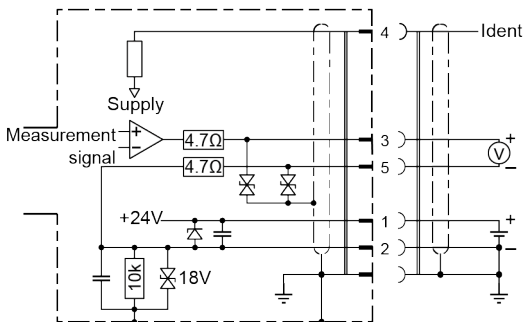


Ground loops, differences of potential, or EMC problems may affect the measurement signal. For optimum signal quality, please do observe the following notes:

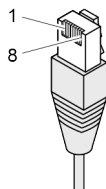
- Connect the cable shield to ground on one side via the connector housing. Do not connect the other side of the shield.
- Connect the supply common with protective ground directly at the power supply.
- Use differential measurement input (signal common and supply common conducted separately).
- Potential difference between supply common and housing ≤ 18 V (overvoltage protection).

Installation

If no sensor cable is available, make one according to the following diagram. Connect the sensor cable.



- Pin 1 Supply
- Pin 2 Supply common, GND
- Pin 3 Measurement signal
- Pin 4 Gauge identification
- Pin 5 Signal common



8-polig
FCC68
Stecker

4 Operation

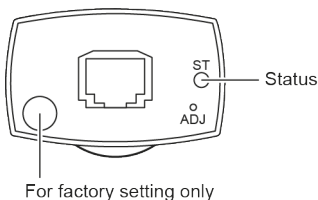
When the supply voltage is applied, the measurement signal is available at the connector (→ "Electrical Connection").

Allow a stabilization period of at least 10 minutes. It is advisable to operate the gauge continuously, irrespective of the pressure.

The gauge is factory calibrated. Due to long time operation or contamination, a zero drift could occur. Periodically check the zero and adjust it if necessary (adjusting the gauge → 25).

4.1 Status Indication and Display

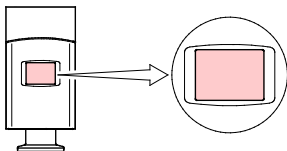
Light-emitting diodes (LEDs)



LED	State	Meaning
<ST>	off	no supply voltage
	lit green	measurement mode
	lit solid or is blinking red	error (→ 26)

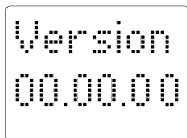
Operation

Liquid crystal display (LCD)



LCD	Meaning
off	no supply voltage
lit green	measurement / parameter mode
lit red	error

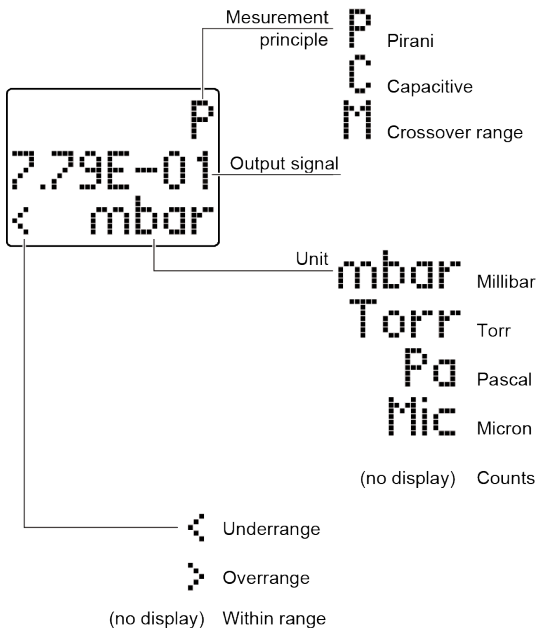
Put the gauge into operation



When the supply voltage is applied the software version is briefly displayed.

Operation

Measurement mode



Error display (trouble shooting → 26)

FAIL
PIR 1

Pirani sensor error

FAIL
CAP 1

Diaphragm sensor error

FAIL
EEPROM

EEPROM error

FAIL
SENSOR

Sensor error

4.2 Gas Type Dependence

Pressure range	Measurement principle	Gas type dependence
10 ... 1500 mbar	diaphragm capacitive sensor	independent of gas type, no correction required
1 ... 10 mbar	diaphragm capacitive sensor and Pirani sensor	crossover range
5×10^{-5} ... 1 mbar	Pirani sensor	proportional to pressure ²⁾

²⁾ The pressure reading applies to dry air, O₂, CO and N₂. For other gases, it has to be converted (calibration factors (→ 12)).

5 Deinstallation



WARNING



Fragile components

The ceramic sensor may be damaged by impacts.

Do not drop the product and prevent shocks and impacts.



DANGER



Contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.



Caution



Vacuum component

Dirt and damages impair the function of the vacuum component.

When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.

Deinstallation



Caution



Dirt sensitive area

Touching the product or parts thereof with bare hands increases the desorption rate.

Always wear clean, lint-free gloves and use clean tools when working in this area.

- 1 Vent the vacuum system.
- 2 Put the gauge out of operation.
- 3 Disconnect the sensor cable.
- 4 Remove gauge from the vacuum system and install the protective lid.

6 Maintenance, Repair



Gauge failures due to contamination and wear and tear, as well as expendable parts (e.g. filament), are not covered by the warranty.

Gardner Denver Thomas assumes no liability and the warranty becomes null and void if any repair work is carried out by the end-user or third parties.

6.1 Adjusting the Gauge

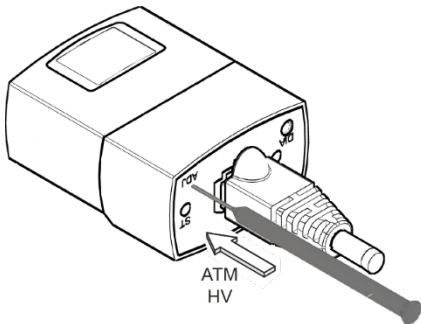
The gauge is factory calibrated. Due to long time operation or contamination, a zero drift could occur. Periodically check the zero and adjust it if necessary.

For adjusting the zero, operate the gauge under the same constant ambient conditions and in the same mounting orientation as normally.

- 1** If you are using a seal with centering ring and filter, check that they are clean or replace them if necessary (→ "Deinstallation").
- 2** Put the gauge into operation and operate it at atmospheric pressure for at least 10 minutes.

Maintenance, Repair

- 3 Press the <ADJ> button with a pin (max. $\varnothing 1.1$ mm) and the ATM adjustment is carried out: The Pirani sensor is adjusted to 1000 mbar by default.



- 4 Evacuate the vacuum system to $p \ll 10^{-5}$ mbar and wait at least 2 minutes.
 - 5 Press the <ADJ> button with a pin and the HV adjustment is carried out: The gauge is adjusted to 5×10^{-5} mbar (default).
- ✓ If the pressure value 4.99×10^{-5} mbar is output at the measurement value output or on the LCD display, the adjustment has been successful. Otherwise, repeat the adjustment procedure.

6.2 Troubleshooting

In the event of a fault or a complete failure of the output signal, the gauge can easily be checked.

Maintenance, Repair

Required tools / material

- Voltmeter / ohmmeter
- Allen wrench, AF 2
- Spare sensor (if the sensor is faulty)

Trouble shooting gauge

The output signal is available at the sensor cable connector.



In case of an error, it may be helpful to just turn off the mains supply and turn it on again after 5 s.

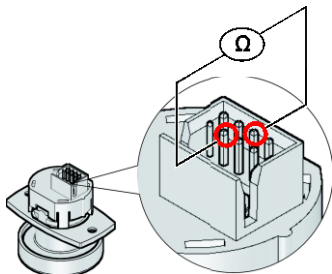
Problem	Possible cause	Correction
Output signal permanently $\approx 0V$ <ST> lit solid red	Sensor cable defective or not correctly connected	Check the sensor cable
	No supply voltage	Turn on the power supply
	Error	Remedy the error
	Gauge in an undefined status	Turn the gauge off and on again after 5 s (reset)
FAIL PIR1 <ST> lit solid red	Pirani sensor defective	Replace the sensor (→ 29)
	Electronics unit not correctly mounted on sensor	Check the connections (electronics – sensor)
FAIL CAP1 <ST> lit solid red	Diaphragm sensor defective	Replace the sensor (→ 29)
	Electronics unit not mounted correctly on sensor	Check the connections (electronics – sensor)
FAIL EEPROM <ST> is blinking red	EEPROM error	Turn the gauge off and on again after 5 s (reset)
		Replace the gauge
FAIL SENSOR <ST> lit solid red	Electronics unit not compatible with the sensor	Replace the sensor (→ 29)
		Replace the gauge



Troubleshooting sensor (Pirani filament)

If the cause of a fault is suspected to be in the sensor, the following checks can be made with an ohmmeter.

Separate the sensor from the electronics unit (→ 29).

Using an ohmmeter, make the following measurements on the contact pins.



Sensor			Possible cause
VMpro1 (W) PN: 620096	$40 \pm 1 [\Omega]$	$\geq 40 \Omega$	Contamination
		$\leq 40 \Omega$	Contamination
		∞	Filament broken
VMpro2 Chem (Ni) PN: 620097	$35 \pm 1 [\Omega]$	$\geq 35 \Omega$	Contamination
		$\leq 35 \Omega$	Contamination
		∞	Filament broken

Correction

All of the above faults can only be remedied by replacing the sensor (→ 29).

6.3 Replacing the Sensor

In case of severe contamination or a malfunction, the sensor can be replaced.



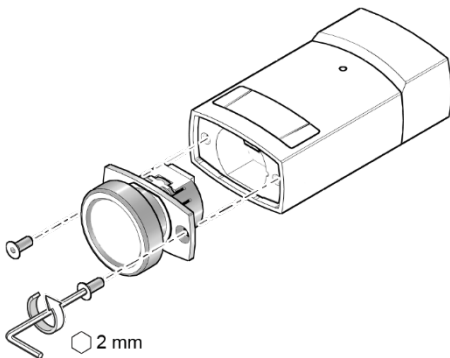
The spare sensor head VMpro1 with W filament (620096-01) may only be used with the gauges VMpro1 with W filament (620096).

The spare sensor head VMpro1 with Ni filament (620097-01) may only be used with the gauges VMpro2 Chem with Ni filament (620097).

Precondition

Gauge deinstalled (→  23).

- 1 Unscrew the hexagon socket screws and remove the sensor without twisting it.



- 2 Place the new sensor without twisting it and lock it with the screws.

7 Returning the Product



WARNING



Forwarding contaminated products

Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment.

Products returned to Gardner Denver Thomas should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination¹⁾.

¹⁾ The damage report form can be downloaded from our website www.gardnerdenver.com/en-gb/welch in the menu "Service" → "Damage Report Form".

Products that are not clearly declared as "free of harmful substances" are decontaminated at the expense of the customer. Products not accompanied by a duly completed declaration of contamination are returned to the sender at his own expense.

8 Disposal



DANGER

Contaminated parts

Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.



WARNING

Substances detrimental to the environment

Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment.

Dispose of such substances in accordance with the relevant local regulations.

Separating the components

After disassembling the product, separate its components according to the following criteria:

- Contaminated components
Contaminated components (radioactive, toxic, caustic or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.
- Other components
Such components must be separated according to their materials and recycled.

Accessories, Spare Parts

9 Accessories, Spare Parts

	Ordering number
Power supply for VMpro1&2, 100-240 V (ac), 50/90 Hz (power supply included in packages 600092 and 600094)	620096-02
Y-cable for analog measurement signal	620096-03
KF Normal Clamping Ring, Aluminium DN 10/16	701011
External Centering Ring with Viton O-Ring, Aluminium, DN 10/16 KF	701151
Centering Ring with Screen and Viton O-Ring, Stainless Steel, DN 16 KF	701191
Hose Connector, Stainless Steel, DN 16 KF – DN 8-10	710743
Hose Connector, Stainless Steel, DN 16 KF – DN 12	701702
Schlenkline adapter NS14/23 – DN 16 KF	710213
Reducer, Stainless Steel, DN 25/16 KF	701401

10 Spare Parts

When ordering spare parts, always indicate:

- all information on the product nameplate
- description and ordering number

	Ordering number
Spare sensor head VMpro1 (W filament)	620096-01
Spare sensor head VMPro2 (Ni filament)	620097-01

EU Declaration of Conformity



We, Gardner Denver Thomas, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electromagnetic compatibility 2014/30/EU and the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2011/65/EU.

Multi-range Vacuum Sensor

VMpro1 (620096)

VMpro2 Chem (620097)

Standards

Harmonized and international / national standards and specifications:

- EN 61000-6-2:2005 (EMC: generic immunity standard)
- EN 61000-6-3:2007 + A1:2011 (EMC: generic emission standard)
- EN 61010-1:2010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Group 1, Class B (EMC requirements for electrical equipment for measurement, control and laboratory use)

Manufacturer / Signatures

Gardner Denver Thomas GmbH, Am Vogelherd 20, D-98693 Ilmenau / Germany

23 October 2020

Robert Götz
Plant manager

Notes

Notes

Notes

Notes



txna56e1

Original: German txna56d1 (2020-11-12)

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