VGPR10020

Digital Pirani Gauge

User Manual

rev. 02

Product Identification
In all communications with ALFAVAC s.r.o., please specify the information on the product nameplate.

Intended Use
The VGPR gauge have been designed for vacuum measurement of gases in the pressure range of atmosphere to 10^{-2} Pa. It operates on the principle of thermal conductivity in which the rate of heat loss from a heated filament is dependent on the pressure of the gas.
The VGPR is a digital gauge and all control functions are carried out over serial communication via RS485. It supports point-to-point or multi-drop communication systems.

Safety
Personnel Qualifications

All work described in this document may only be carried out by persons who have suitable technical training.

General Safety Instructions
• Adhere to the applicable regulations and take the necessary precautions for the process media used.
• 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.

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.

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.

Liability and Warranty
ALFAVAC s.r.o. 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.

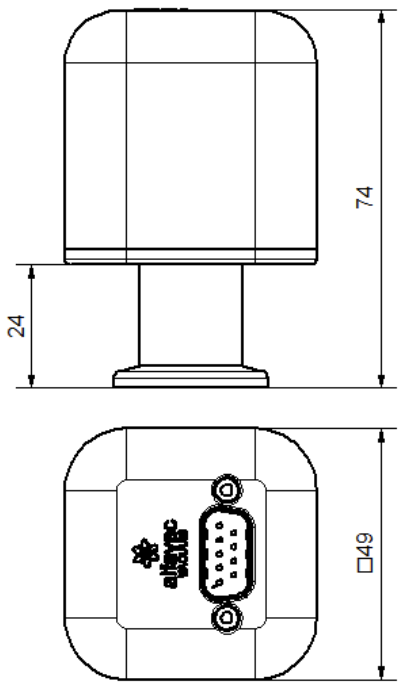
The end-user assumes the responsibility in conjunction with the process media used.

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

Technical Data

Measurement principle	Thermal conductance according to Pirani
Measurement range	ATM to 10^{-2} Pa
Accuracy	±50% (ATM to 100 hPa), ±15% (100 hPa to 10^{-1} Pa), ±50% (10^{-1} to 10^{-2} Pa)
Repeatability	2% of reading (100 hPa to 10^{-1} Pa)
Supply voltage	10 to 35 VDC (acc. IEC 61010-1)
Max. power consumption	1.5 W
Max. inrush current	1 A
Electrical connection	D-SUB 9 pin male
Serial output	RS-485
Serial line - max. input	-8 V to 12.5 V
Serial line - differential driver output	min 1.5 V, max 5 V (27 Ohm load)
Serial line - max. input current	1 mA
Serial line – default setup	9600 baud, 8 bits, 1 stop bit, no parity
Max. baud rate	38400 baud
Operating temperature range	5 to 60°C
Storage temperature range	-30 to 70°C
Max. bake-out (electronics removed)	150°C
Max. relative humidity	80%
Max. altitude	3000 m
Max. internal pressure	10 bar
Pollution degree	2
Materials exposed to vacuum - filament	Tungsten/Platinum
Materials exposed to vacuum - other	Stainless steel 304, Glass, Ni
Protection class	IP 40
Certifications	CE, RoHS, REACH
Connecting flange	ISO-KF 16
Service	Replaceable filament and electronics

Dimensions mm



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 ambient conditions and in the same mounting orientation as normally. The gauge should be calibrated when gas type is nitrogen or air, the other gases are not supported.

1. Operate the gauge at ATM pressure for at least 10 minutes (warm-up time).
2. Send command !S761 1. The status is displayed in the gauge status bit when read pressure command is send via RS485.
3. Evacuate to 10^{-3} Pa (or less) and wait at least 2 minutes.
4. Send command !S761 1. The status is displayed in the gauge status bit when read pressure command is send via RS485. The output of the gauge will be calibrated automatically.

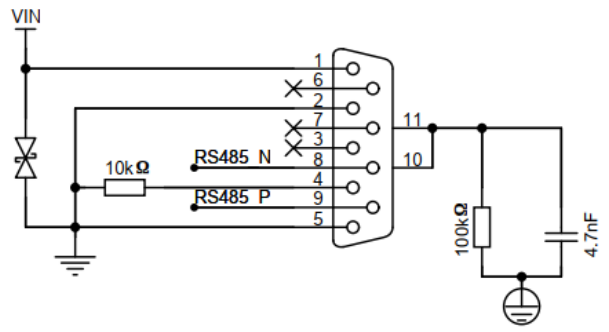
Installation
To connect the gauge to vacuum system use a centering sealing ring ISO-KF 16. Make sure that the vacuum system has a correct earth (ground) connection. The gauge can be installed in any direction, however vertical direction from top is preferred.

WARNING: High Pressure
Risk of damage to equipment. If the pressure is more than the atmospheric pressure, the standard centering rings are not applicable.

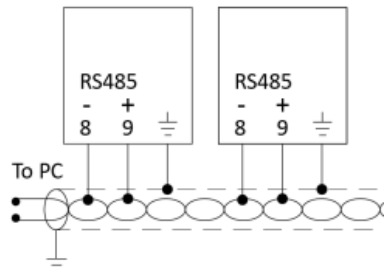
Electrical Installation
Use the pins on the electrical connector as shown in the following table. Maximum cable length is 100 m.

Pin	Description
1	Electrical supply positive (VIN)
2	Electrical supply ground (GND, 0 V)
3	Not connected
4	ID resistor
5	RS485 common
6	Not connected
7	Not connected
8	RS485 negative/Data B/Inverted line
9	RS485 positive/Data A/Non-inverted line

Electrical connection schematics:



Connect to the Serial Interface
The gauge has built in RS485 interface which can be used for point-to-point or multi-drop communication. RS485 uses two lines for differential data transfers. Multiple gauges can be connected to the same serial bus. It is recommended to use the shielded twisted pair cable to reduce interference problems. Long links may require the additional 120 Ohm terminating resistors at each end to improve communication reliability.



Operation
In the case of cold start the gauge should be warmed-up for at least 10 minutes before the actual measurement. If this step is not followed it may cause incorrect measurements.

WARNING: High temperature of the filament
Risk of injury or damage to equipment. Do not use the gauge to measure explosive or flammable gases or mixtures. The gauge has a heated filament.

Serial Communication
The communication is ASCII based text and works on the client/server principle. The gauge is the server and will only transmit a message in response to client which must always start the conversation.

Message Basics
A conversation consists of a message to the gauge and its response. The response must be received before continuing.

Message Structure
Commands follow a standardized structure to address devices and specify actions.

#<Destination ID>:<Source ID><Command>

Multi-Drop header:
1. # Denotes the start of a message.
2. <Destination ID> Two-digit identifier for the target device (e.g., 01 for device 1, 00 for broadcast).
3. : Separator between IDs.
4. <Source ID> Two-digit identifier for the sending device.

Message contend:
5. <Command> The actual instruction for the gauge.

Example:
#01:02?V752 Request pressure from device 01, sent by device 02.
#00:01!S755 2 Broadcast to all devices, setting the pressure units to Pascal.

Response Format
=<Command><Data>;<Status>
or
*<Command><Data>;<Status>

1. = or * Denotes the start of a response.
2. <Command> The command that triggered the response.
3. <Data> The data requested or acknowledgment of the action.
4. <Status> Number representation of the gauge operational status.

In the case of multi-drop configuration, the multi-drop header is used before response contend.

Example:
=V752 1.23;2 Pressure is 1.23 with status 2 (e.g., calibration in progress).

Multi-Drop
In multi-drop configuration, each device is assigned a unique node address (1-98). Address 00 is reserved for broadcasting (point-to-point) commands to all devices. Only devices matching the Destination ID will respond, ensuring proper communication in networked setups. In point-to-point communication the multi-drop header can be omitted.

Supported Commands

Command	Description
?V752	Request pressure and status.
!S755 <n>	Set pressure units.
!S756 <n>	Set gas type.
!S753 <n>	Lock/unlock gauge settings.
!S750 <n>	Set node address.
?S750	Read node address.
!C780 <n>	Set RS485 baud rate.
?S790	Request gauge serial number.
?S0	Request gauge identity and firmware version.
!S757 1	Reset gauge to factory defaults.

Error Handling
The error codes are sent within the response in Data section and the code 00 means OK state (no error).

Error Code	Description
*E1	Unknown command.
*E4	Parameter out of range.
*E5	Invalid command in current state (e.g., locked).

Gauge Status
The gauge status value is representation of various operational states and error flags. Each value represents a specific condition or flag.

Value	Description
0	Sensor OK.
1	Sensor error (e.g., sensor malfunction or filament rapture).
2	Calibration in progress.

Pressure Units
Sets the pressure units for the gauge measurement.
Command: !S755 <value>
Response: *S755 00 (OK) or *E4 (Parameter out of range)
Restrictions: The command will not execute if the gauge settings are locked.
Example: !S755 1 (Sets pressure units to mbar)

Value	Description
1	mbar
2	Pascal (default)
3	Torr

Gas Types
Changes the gas type affecting pressure measurement.
Command: !S756 <value>
Response: *S756 00 (OK) or *E4 (Parameter out of range)
Restrictions: The command will not execute if the gauge settings are locked.
Example: !S756 3 (Sets gas type to Helium)

Value	Description
0	Nitrogen
1	Argon
2	CO_2
3	Helium
4	Krypton
5	Neon
6	Xenon
7	Air (default)

Lock/Unlock Gauge
Locks or unlocks the gauge settings to prevent configuration changes. The change attempt of the locked gauge will result in *E5 error (Invalid command in current state).
Command: !S753 <value>
Response: *S753 00 (OK) or *E4 (Parameter out of range)
Example: !S753 1 (Locks settings)

Value	Description
0	Unlock (allows changes)
1	Lock (prevents configuration changes)

Baud Rates
Changes the RS485 communication baud rate for the gauge.
Command: !C780 <value>
Response: *C780 00 (OK) or *E4 (Parameter out of range)
Example: !C780 5 (Sets baud rate to 115200)

Value	Description
1	38400 baud
2	19200 baud
4	9600 baud (default)
5	115200 baud
6	230400 baud

Pressure measurement
This command requests the current pressure reading and the gauge status.
Command: ?V752
Response: =V752 <pressure>;<status>
Example Response: =V752 1.23;0

Set Node Address
Sets the node address for the gauge in a multi-drop configuration. Integer specifying the RS485 node address (valid range: 1 to 98). Setting 0 disables multi-drop mode (default).
Command: !S750 <address>
Response: *S750 00 (OK) or *E4 (Parameter out of range)
Example: !S750 5 (Sets node address to 5)

Read Node Address
Requests the current node address of the gauge.
Command: ?S750
Response: =S750 <nodeAddress>
Example: =S750 5

Serial Number
Requests the serial number of the gauge.
Command: ?S790
Response: =S790 <serialNumber>

Gauge Identity
Requests the gauge's identity and firmware version.
Command: ?S0
Response: =S0 <gaugeID>.<version>

Reset to Factory Defaults
Resets the gauge configuration to factory default settings. It sets units to Pascal, gas type to Air, node address to 0 (multi-drop disabled) and unlock the settings.
Command: !S757 1
Response: *S757 00 (OK)

Gauge Calibration
Calibration of gauge output. See Adjusting the Gauge chapter.
Command: !S761 1
Response: *S755 00 (OK) or *E5 (Invalid command)

Maintenance
Cleaning vacuum flange:
1. Remove the gauge from the vacuum system
2. Fill the gauge flange with isopropyl alcohol
3. Allow 5 minutes for the isopropyl alcohol to take effect
4. Dry or bake-out the isopropyl alcohol from the gauge flange. The bake-out temperature should not extend 150 °C. Remove electronics before bake-out procedure.
5. Reconnect the gauge to the vacuum system

In case of severe contamination or a malfunction, please contact TF for reparation.

Product Compliance

CE

RoHS compliant

REACH COMPLIANT