DigiVac
Scientific Measurement & Control

DPP Quantum Vacuum transducer

MEMS-Pirani & Piezo diaphragm sensor

JANUARY 2022

Operational Manual

YOU MUST READ THIS MANUAL BEFORE USE

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DigiVac
Scientific Measurement & Control

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Overview

General information

Thank you for purchasing this DigiVac product. This operating manual contains important safety information, and we encourage you to read this manual and the quick start guide prior to installation and use of this product.

Symbols used

The following symbols are used in this manual:

WARNING! Critical information to prevent dangerous situations that can result in serious injury or death.

CAUTION! Important information to prevent dangerous situations that can damage the device or auxiliary equipment.

ACTION! Requires action or attention.

INFORMATION: Important recommendations and information for efficient use and best practice.

Intended use

The DPP vacuum transducer is intended for non-corrosive vacuum gas pressure measurement and control within the limits listed in the specifications on page 29. The device is designed for KF fittings or screw-in fittings mounting.

The device complies with EMC (Electro Magnetic Compatibility) class B immunity requirements for industrial environments.

Safety information

This product should be installed and operated by technically skilled or trained personnel only.

WARNING! This product is not intended for installation and use in the presence of flammable gases or other explosive environments.

WARNING! Ensure that the gases or liquids exposed to the wetted materials are compatible with the wetted materials described in the specifications table and the used sealing materials.

WARNING! The pressure rating of the sensor elements, connecting process fittings and sealing must comply with the maximum possible pressure in the application. The CE marking on the device does not apply to the pressure equipment directive (PED) (2014/68/EU).

WARNING! Ensure that the process connection is tightened according to the recommended torque specification. Ensure that there are no leaks from the process connection before pressurizing the installation.

WARNING! Do not remove the transducer from the installation when the installation is evacuated, pressurized or contains hazardous fluids.

WARRANTY

DigiVac warrants this product under normal use and service to be free from defects in materials and workmanship for a period of twenty-four (24) months from the date of the delivery.

Warranty does not cover mechanical damage, corrosive damage, physical contamination, deposition contamination, damage caused by shipping, normal wear and tear, incorrect use, misuse, incorrect installation
or operation beyond the published design limits and specifications.

In case of warranty claim the customer should notify DigiVac immediately and no later than 3 weeks after the defect has been discovered. The warranty claim must specify the failure mode and other relevant information about the product defect and the application use.

DigiVac can request return of a failed product for examination and root cause analysis that arises from a warranty claim. DigiVac will at its discretion credit, repair or replace the failed products that are accepted to be covered by warranty.

Warranty is void, regardless of the root cause of defect, if a product has been exposed to or contaminated with radioactive, chemical, biological or other harmful or dangerous substances.

Warranty does not apply to products that have been hardware modified, altered or dismantled by the customer or third party.

Software provided by DigiVac is supplied “as is” without warranty of any kind or guaranteed compatibility with customer IT systems and environment.

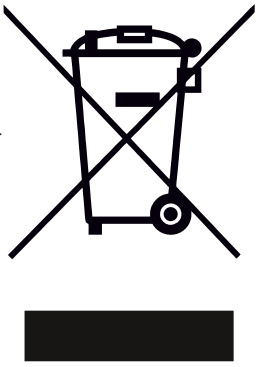
DISPOSAL IN THE EUROPEAN UNION

At the end of life of this product, it must be disposed according to the European Directive 2012/19/EU (WEEE). This product should not be mixed with general household waste.

WARNING! If the product has been exposed to human or environmental hazards materials during its use, ensure proper decontamination before disposal.

For proper treatment, recovery and recycling, please take this product to designated collections points. Please contact your local authority for further details of your nearest designated collection point.

For questions regarding disposal please contact your dealer or DigiVac for further information



RETURNS

All returns to DigiVac must be authorized by DigiVac by issuing an RMA (Returned Material Authorization) prior to shipping. Contact DigiVac support to obtain an RMA number and fill out the form on page 28

DigiVac will not accept return of products that have been exposed to or contaminated with radioactive, chemical, biological or any other harmful or dangerous substances.

Return of unpacked and unused products for credit requires written acceptance from DigiVac and will be subject to a handling fee.

TRADE RESTRICTIONS AND EXPORT CONTROL

DigiVac Quantum Sensors DCP and DPCP are only distributed and sold in the United States. DigiVac's Quantum Sensor DPP is available and can be distributed to any and other countries or territories seeking to obtain the product.

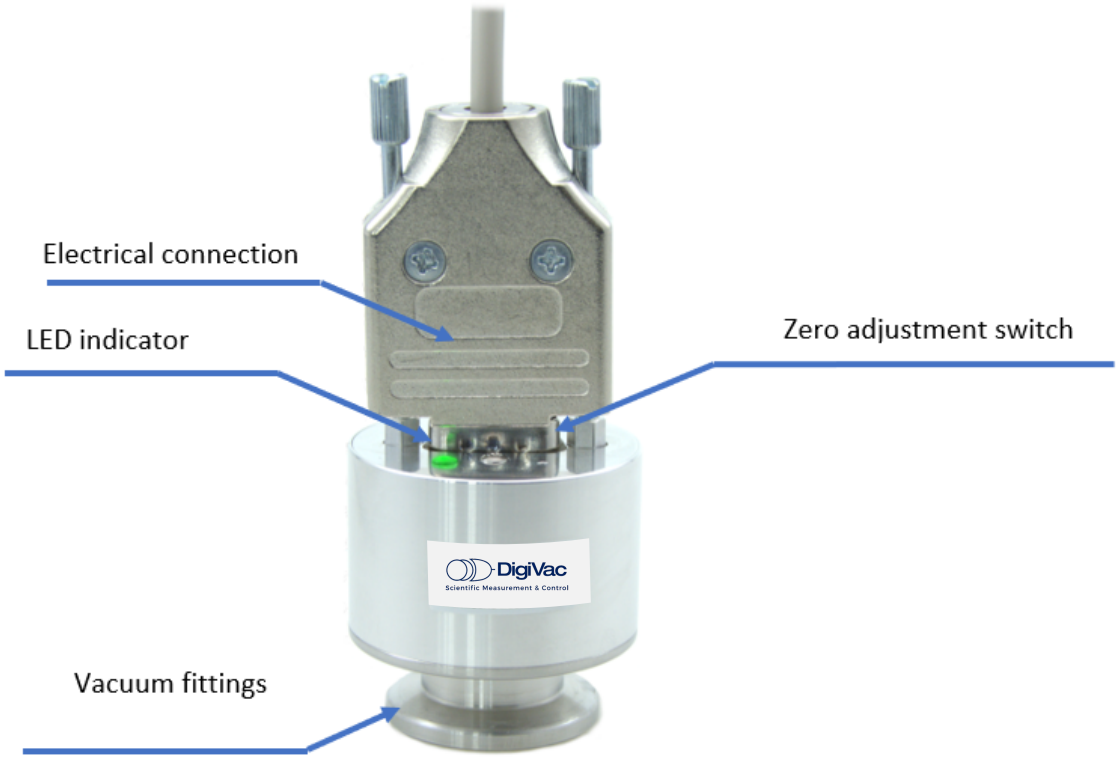
LIABILITY

The customer is solely responsible for determining the suitability and compatibility of the product for the customers application, environment and intended use. DigiVac is not liable for any claims arising from improper use, incorrect installation or use with gases or liquid not compatible with the media wetted materials described in the specifications table. To the extent permitted by law, DigiVac is not liable for incidental and consequential damages, including but not limited to loss of profits or revenue, overheads, loss of data, reinstallation costs, damage to other equipment or any incidental or consequential damages of any nature.

DigiVac has taken reasonable care to ensure that the content of its published information and specifications is accurate and up-to date. However, DigiVac does not guarantee or warrant that the content of the published
information is error-free. DigiVac reserves the right to change its product specifications without prior notice.

DPP QUANTUM TRANSDUCER

The DPP is available with different electrical connections and vacuum fittings. The illustration below is an example of the DPP with D-sub connector and DN16KF vacuum fitting.

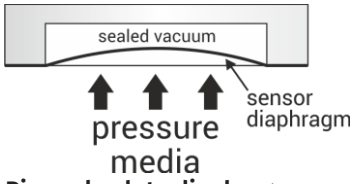


LABELING

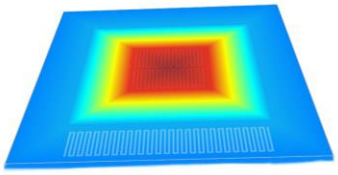
If the serial label should become unreadable, the serial- and part numbers are also stored in the internal non-volatile memory and can be reached through DigiVac.

ABOUT THE DPP VACUUM TRANSDUCER

The DPP transducer is based on patent pending technology that offers best-in-class performance and has established new standards by extending the useable measuring range for thermal conductivity vacuum gauges by 1-3 decades. The DPP combines a MEMS (Microelectromechanical Systems) heat-loss Pirani sensor with a Piezo diaphragm sensor.



Piezo absolute diaphragm


Heat-loss diaphragm pressure

The piezo MEMS sensor consists of a diaphragm where one side of the diaphragm is exposed to the vacuum gas and the other side is exposed to a sealed reference vacuum. The applied pressure deflects the diaphragm and the deflection is converted to an electric signal.

The MEMS Pirani sensor is based on a resistive element deposited on an ultra-thin diaphragm suspended in the vacuum gas to measure. The diaphragm is permanently mechanically fixed and does not bend or move with changes in vacuum gas pressure. The resistive element is made of nickel that offers a high temperature coefficient. The vacuum gas pressure is determined by measurement of the pressure dependent heat-loss
from a heated resistive element. The measurement of heat-loss is gas concentration and gas type dependent.

MEASUREMENT PERFORMANCE

The DPP has established new performance standards and extended range for heat-loss Pirani gauges. It combines a MEMS diaphragm piezo sensor with heat-loss MEMS Pirani sensor.

The diaphragm sensor eliminates the well-known gas dependency in the rough vacuum range of thermal conductivity gauges. The Piezo offers precision performance comparable to more expensive capacitance manometers. This feature ensures more accurate control of vacuum system venting processes and can prevent over-pressurization of the vacuum system.

MEASUREMENT ACCURACY TORR

From	to	Accuracy
7.5×10^{-6}	7.9×10^{-5}	50%
7.5×10^{-5}	5.99×10	14%
6.0×10	7.43×10^{-1}	5%
7.9×10^{-1}	1000 Torr	2%

The MEMS-Pirani provides measurement resolution down to 7.5×10^{-6} Torr.

PART NUMBERS

The DPP is available with different electrical connections and process fittings. The illustration below is an example of the DPP with DN16KF, RS-232, 0.5-9.5 VDC analog output, mbar unit, 3 relays and 15-pin HD D-sub

DPP	1	0	1	0	1	2	3	2

Vacuum flange

DN16KF	1	0
DN25KF	2	0
NPT 1/8"	3	0
VCR4	4	0
DN16KF Extended	8	0
DN16KF with light baffle	1	1
DN16KF with heavy duty baffle	1	2

Digital interface

RS232 / S4-Connect™	1
RS485 / S4-Connect ™	2
S4-Connect™	3

Analog Output

0.5 - 9.5 (1 V/dec)	0	1
1.0-9 VDC 1 VDC/Dec (MKS 901P/925/910)	0	2
0.375 to 5.659 VDC (MKS GP275)	0	3
0.5V DC (MKS 523)	0	4
1.9-10 VDC (Inficon PSG55x, Leybold TTR91)	0	5
1.5-8.5 VDC (Pfeiffer TPR260/27x/28x)	0	6
1.9-9.1VDC Edwards APG100XLC	0	7
1.9-9.1VDC (Edwards APG100XM)	0	8
0-10 VDC 0.1Torr FS Capacitance manometer	1	0
0-10 VDC 1 Torr FS Capacitance manometer	1	1
0-10 VDC 10 Torr FS Capacitance manometer	1	2
0-10 VDC 100 Torr Capacitance manometer	1	3
0-10 VDC 1000 Torr Capacitance manometer	1	4
Pkr251 / MPG 500	3	6

Connection

1	9 Pin D-sub male
2	15 pin HD D-sub male
3	15 pin HD D-Sub male / dual analog out
4	6 pin Hirschmann, ID res 3K
5	6 pin Hirschmann, ID res 5.1K
6	6 pin Hirschmann, ID res 9.1K/11.1K
7	8 pin RJ45 / FCC68, ID Res 27K
8	8 pin RJ45 / FCC68, ID Res 36K
9	8 pin RJ45 / FCC68, ID Res 43K

Setpoints

0	None
1	1x Solid State Relay
2	2x Solid State Relays
3	3x Solid State Relays

Unit

1	torr
2	mbar
3	Pascal

***Note: The ones marked are the parts the DigiVac has in stock and readily available. However DigiVac is able to acquire all other through ordering.**

CALIBRATION

The DPP is delivered factory-calibrated with a calibration test report. An optional accredited calibration traceable to national standards can also be supplied with the DPP transducer.

Mechanical installation

The DPP transducer is available with KF clamp fittings or screw-in fittings.

⚠ **CAUTION!** For screw-in fittings do not exceed tightening torque values.

⚠ **CAUTION!** Use gloves when handling vacuum fittings**.** Ensure that the O-ring and vacuum sealing surfaces are clean and free of scratches or other damages.

The DPP transducer can be mounted horizontally or vertically without impact on accuracy or performance.

Application and process compliance

The DPP transducer is intended for use in vacuum applications where non-corrosive gases are present.

Electrical installation

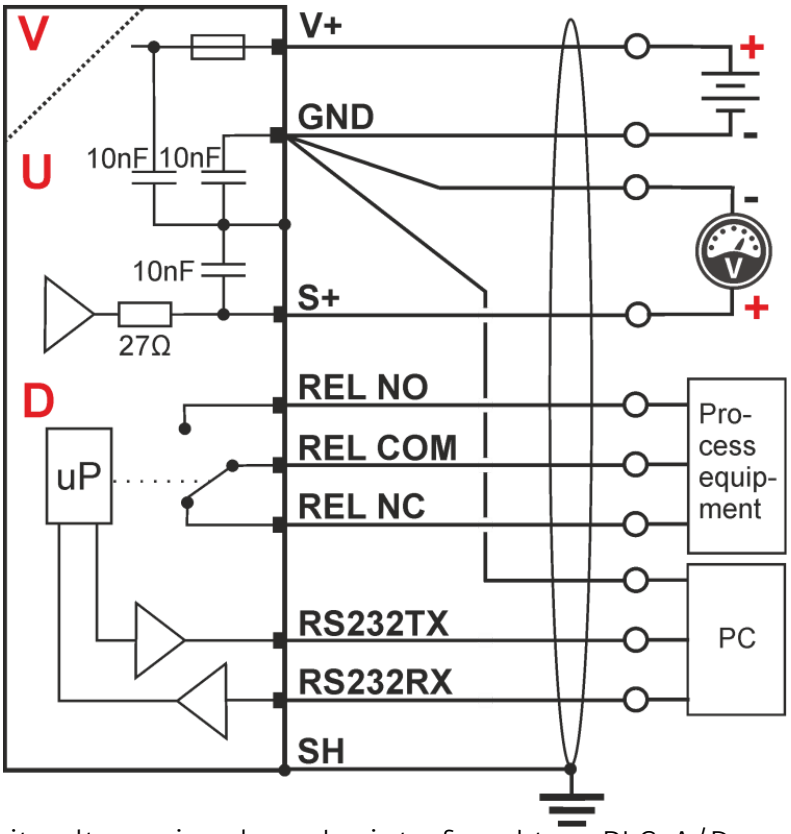
The DPP requires an external power supply supplying in the range 12-30 VDC. The external power supply shall be with safe isolation according to PELV (Protective Extra Low Voltage) requirements of EN60204-1.

The transducer is protected against momentary overvoltage on the supply line. The internal 100 mA thermal fuse will limit current draw in case of overvoltage to limit overheating. Additionally, the transducer is protected against reverse polarity caused by incorrect wiring to the power supply.

The transducer electronics have a high level of immunity against external electromagnetic interference.

Electrical connection (D-sub)

The voltage output version provides a voltage signal proportional to the measured pressure.



The high resolution 16-bit voltage signal can be interfaced to a PLC, A/D converter, voltmeter or other readout devices.

INFORMATION: It is recommended to use a differential input to measure the output signal that uses a separate signal return wire connected to the transducer connector. If power supply return and signal return share the same wire connection the voltage drop as function of supply current will cause a measurement deviation. In that case, the measurement deviation will increase with the cable length.

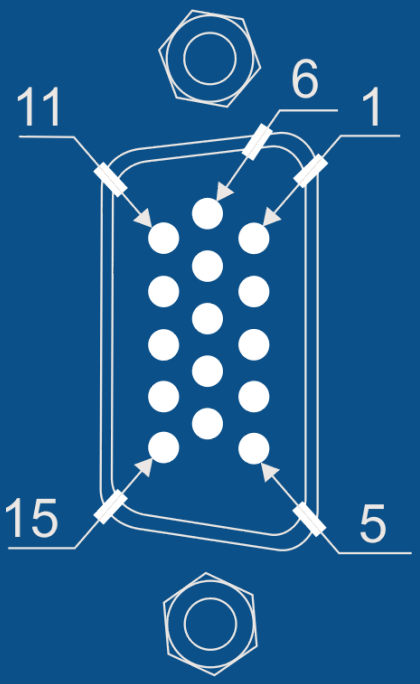
DPP Quantum

Connector pinout and cable wiring (0-10 VDC voltage output)

15-pin HD D-sub connector

Pin	Symbol	Description
1	RS232TX	RS-232 Transmit / RS-485 (-)
2	RS232RX	RS-232 Receive / RS-485 (+)
3	V+	Supply voltage 12-30 VDC
4	GND	Supply voltage – (return)
5	S+	Analog voltage signal +
6	GND	Analog voltage signal – (return)
7	REL NO	Relay 1 NO (normally open contact) (1)
8	REL COM	Relay 1 Common (1)
9	REL NC	Relay 1 NC (normally closed contact) (1)
10	REL NC	Relay 2 NC (normally closed contact) (1)
11	REL COM	Relay 2 Common (1)
12	REL NO	Relay 2 NO (normally open contact) (1)
13	REL NC	Relay 3 NC (normally open contact)(1)
14	REL COM	Relay 3 Common (1)
15	REL NO	Relay 3 NO (normally open contact) (1)

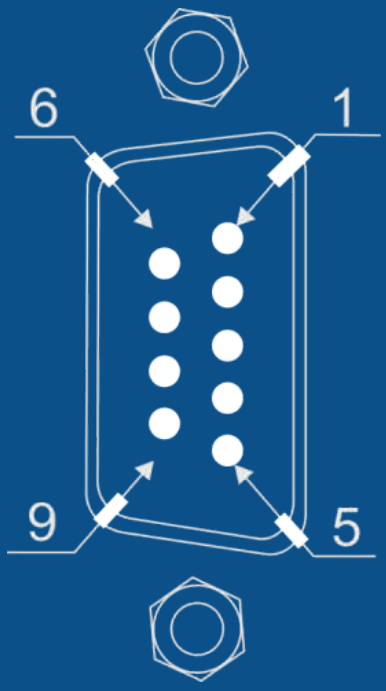
(1) Optional relay



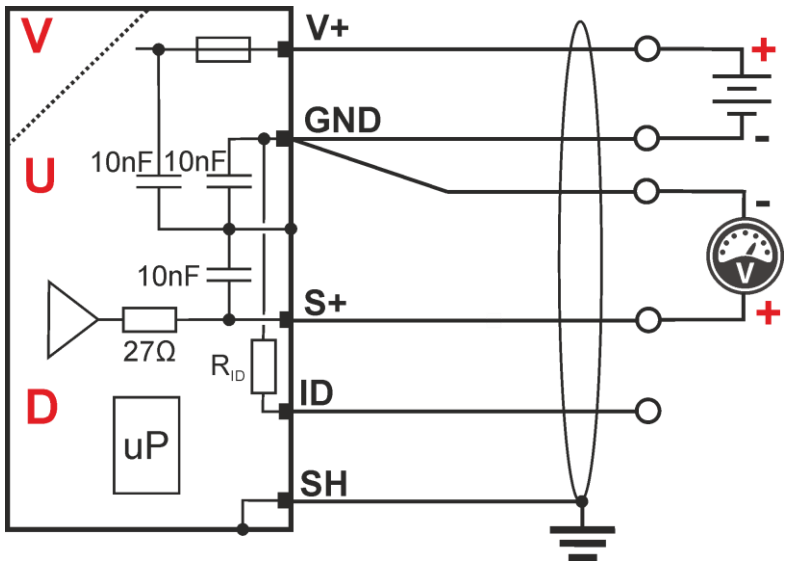
9-pin D-sub connector

Pin	Symbol	Description
1	REL NO	Relay 1 NO (normally open contact)(1)
2	REL NC	Relay 1 NC (normally closed contact) (1)
3	V+	Supply voltage 12-30 VDC
4	GND	Supply voltage – (return)
5	S+	Analog voltage signal +
6	REL COM	Relay 1 Common(1)
7	RS-232TX	RS-232 Transmit / RS-485 (-)
8	GND	Analog voltage signal – (return) RS-
9	232RX	RS-232 Receive / RS-485 (+)

(1) Optional relay

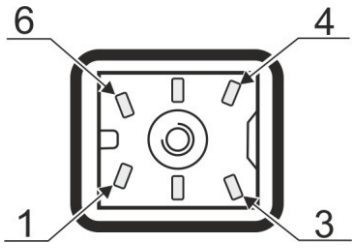


Electrical connection (Hirschmann GO-6 connector)



6-pin Hirschmann GO-6 connector

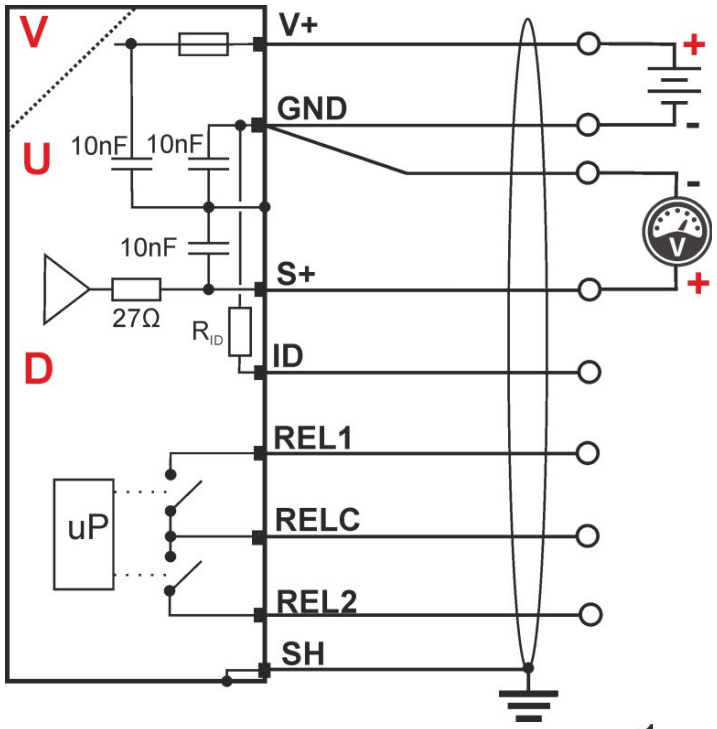
Pin	Symbo	Description
1	ID	Identification resistor (3K)
2	S+	Analog voltage signal +
3	GND	Analog voltage signal –
4	V+	(return) Supply voltage 12-30
5	GND	VDC Supply voltage – (return)
6	CH	Chassis



INFORMATION: It is recommended to use a differential input to measure the output signal that uses a separate signal return wire connected to the transducer connector. If power supply return and signal return share the same wire connection the voltage drop as function of supply current will cause a measurement deviation. In that case, the measurement deviation will increase with the cable length.

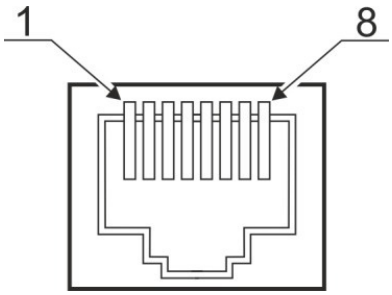
DPP Quantum

Electrical connection (RJ45/8P8C connector)



RJ45/8P8C connector

Pin	Symbol	Description
1	V+	Supply voltage 12-30 VDC
2	GND	Supply voltage – (return)
3	S+	Analog pressure voltage signal +
4	ID	Identification resistor(7)
5	GND	Analog voltage signal – (return)
6	REL2	Relay 2 Setpoint (closing contact)
7	REL1	Relay 1 Setpoint (closing contact)
8	RELC	Relay 1 and 2 common



(7) Identification resistor for RJ45/8P8C connector

The identification resistor is used by external equipment to identify the type of transducer. External equipment can be a display or a controller from another vendor. The DPP is available with different ID resistors. The ID resistor is identified by the last digit in the part number:

P/N	ID resistor value
5	27 KΩ
6	36 KΩ
7	43 KΩ

INFORMATION: It is recommended to use a differential input to measure the output signal that uses a separate signal return wire connected to the transducer connector. If power supply return and signal return share the same wire connection the voltage drop as function of supply current will cause a measurement deviation. In that case, the measurement deviation will increase with the cable length.

Status LED

The LED indicator signals the transducer status and can indicate following basic indications:

Startup sequence

- 0.5 sec purple followed by 4 sec. pulsing green

Normal standard operation

- Solid green

Overpressure indication (in Dynamic Mode only)

- Flashing Orange (5 Hz)

S4-Connect mode

- Pulsing green

Sensor fail stage

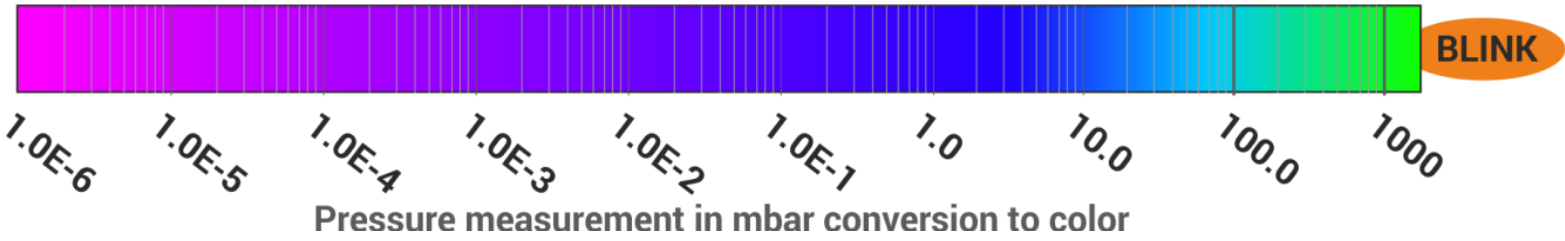
- Flashing red (5 Hz)

RGB LED for pressure indication (Dynamic mode)

The DPP introduces a new approach for visually determining the measured pressure by a multi-color LED that smoothly changes color throughout the pressure range. This selectable visual function is a low-cost alternative to integrated displays and provides a rough visual indication of the measured pressure.

When the DPP measures a pressure that exceeds its maximum measuring range of 1333 mbar (1000 Torr) the LED will blink orange.

The dynamic LED can be enabled via the digital interface. Refer to page 16 for LED configuration.



Signal-to-pressure conversion (0-10 VDC voltage output)

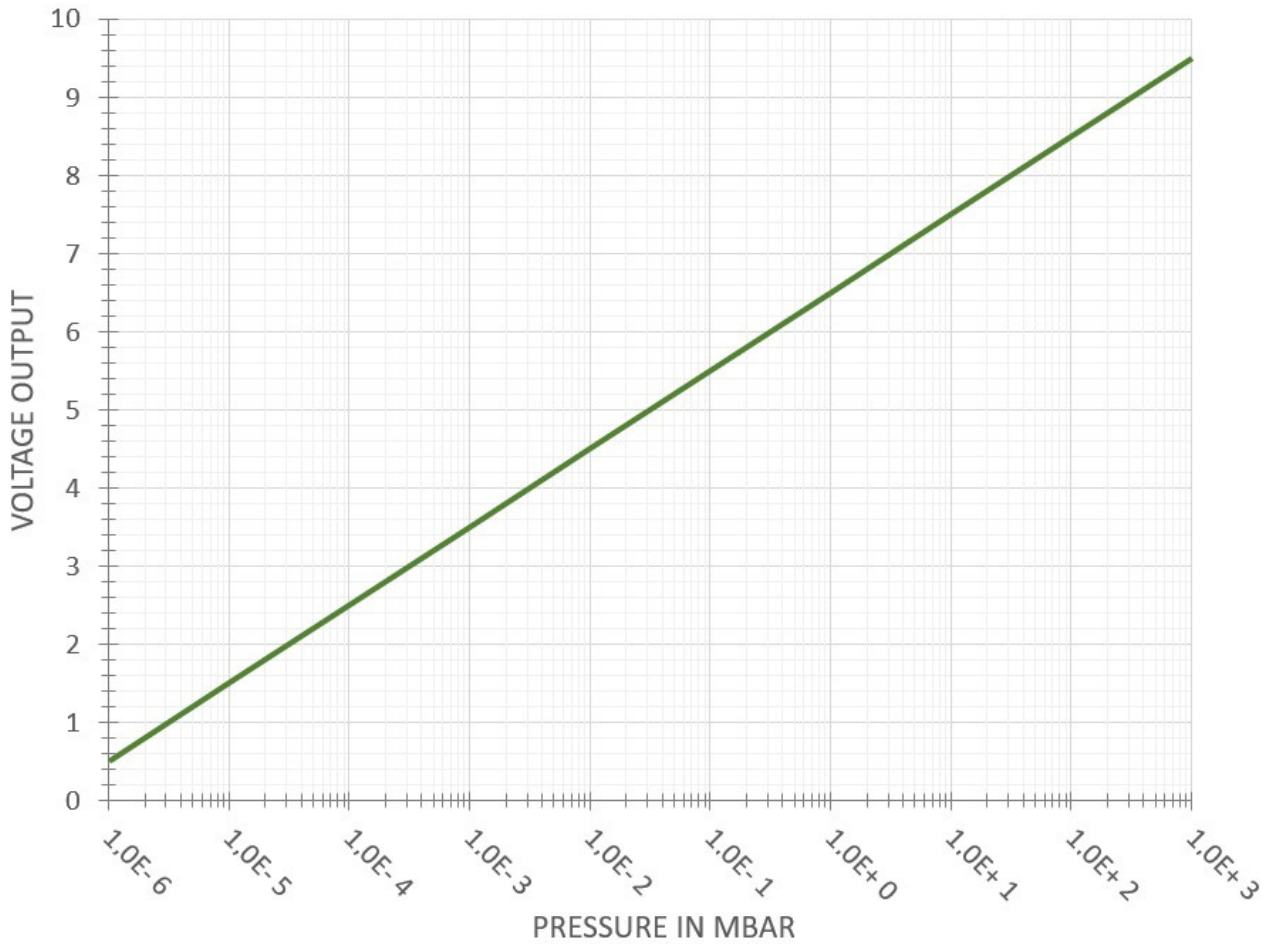
The transducer can provide a voltage output from 0-10 VDC and is available with different types of pre- configured output scaling.

In the DPP's standard configuration with a voltage output of 1 VDC/decade, the output is scaled according to the configured pressure unit, e.g. when mbar is selected the transducer will provide 1 VDC per decade mbar. Likewise, when the unit is changed to torr, the transducer will provide 1 VDC per decade torr. Finally, when the unit is changed to Pascal, the transducer will provide 1 VDC per decade Pascal.

The voltage signal u can be converted to pressure using the following linear expression:

Voltage to pressure conversion (mbar and torr): $P(u)=10(u-6.5)$

Voltage to pressure conversion (Pascal): $P(u)=10(u-4.5)$



Other vendors analog output emulation

The DPP analog output emulation offers voltage output pressure scaling compatible with other vendors gauges. This feature enables drop-in replacement of gauges from other vendors. Configuration and list of analog output options can be found on page 15.

Digital vacuum pressure and temperature measurement

The real-time digital vacuum gas pressure value and vacuum gas temperature can be acquired through the digital interface.

Device Address (ADR)

The DPP has an addressable communication protocol, and so it will only accept commands or queries with the following addresses. All queries or commands sent to all other addresses are simply ignored.

<device address>	Pre-configured to 253, this value may be changed at any time to anything in the range 1-253 using the ADR command.
254	This is the ”global” address. The DPP will always respond to commands or queries at address 254, regardless of the device address setting.
255	This is the broadcast address, which may be used for performing the same operation on multiple DPPs at once. The DPP will not issue any replies to broadcast commands. Note that broadcasting requires a multidrop communication interface such as RS-485.

Example: Change the device address from 253 (default) to 123 using the global address:

Send: **@254ADR!123**

Reply: **@253ACK123**

All replies after this one will begin with the new device address, 123.

Analog Output Configuration (AOUT)

DPP's default analog output is 0.5-9.5 V, 1V/decade, however, the analog output can be configured to emulate a collection of other equipment via the AOUT command:

	Vendor	Transducer model	Output
STD	Sens4	VPM-4, 5, 7, 15, 17	1 VDC/decade (0.5 – 9.5 VDC)
LINEAR	Sens4	-	Programmable linear
0	MKS	901P, 910, 925	1 VDC/decade (1-9VDC)
1	Edwards	APG-L	1.99 - 10 VDC
2	Edwards	APG-100	2.00 – 9.00 VDC
3	Edwards	WRG	2.75 – 10.00 VDC
4	Inficon	PSG500	1.547 – 10.00 VDC
	Leybold	TTR91	
5	Inficon	MPG400	2.07 – 8.603 VDC
	Pfeiffer	PKR251	
6	Inficon	BPG400	1.843 – 10.00 VDC
	MKS	999 Quattro	
7	MKS Granville Phillips	275	0.372 – 5.570 VDC
8	MKS HPS	Moducell 325	0.2509 – 3.2398 VDC
9	MKS HPS	Moducell 325 x3	0.753 – 9.719 VDC
10	MKS	Baratron® 0.1 Torr	0 - 10.00 VDC
11	MKS	Baratron® 1 Torr	0 - 10.00 VDC
12	MKS	Baratron® 10 Torr	0 - 10.00 VDC
13	MKS	Baratron® 100 Torr	0 - 10.00 VDC
14	MKS	Baratron® 1000 Torr	0 - 10.00 VDC
15	MKS	901P piezo differential output	1 VDC/decade
16	Edwards	AIM-S / - SL	2.5 – 10.00 VDC
17	Edwards	AIM-X / XL	3.286 – 9.799 VDC
18	Pfeiffer	IKR251	2.324 – 8.500 VDC
19	Pfeiffer	TPR 265 / 280	2.199 – 8.625 VDC
20	Hastings	HPM-2002-OBE special	5.00 – 9.995 VDC
21	Edwards	DV6M	2.00 – 10.00 VDC
22	Edwards	APG-M	2.00 – 10.00 VDC
23	MKS Granville Phillips	GP275 (0-9.0 VDC)	0 – 8.80 VDC
24	Thyracont	MT 241.1	0.41 – 9.99 VDC
25	MKS Granville Phillips	(0-375.6VDC)	0.375 – 5.614 VDC
26	Edwards	APG100-LC	2.00 – 10.00 VDC
27	Edwards	APG100M	2.00 – 10.00 VDC
28	MKS	907	0.387 – 5.666 VDC
29	Alcatel	K6080	0.40 – 10.00 VDC
30	Inficon	PEG100	2.186 – 10.166 VDC
31	Varian	Eysys	1.00 – 8.00 VDC
32	Alcatel	TA111	0.10 – 9.20 VDC
33	MKS	685	1.00 – 7.00 VDC
34	MKS	901P special 2VDC/decade	1.00 – 9.00 VDC
35	Pfeiffer	TTR 101	0.61 – 10.2 VDC
50	MKS/Inficon	0.1 mbar full scale (linear)	0 - 10.00 VDC
51	MKS/Inficon	1 mbar full scale (linear)	0 - 10.00 VDC
52	MKS/Inficon	2 mbar full scale (linear)	0 - 10.00 VDC
53	MKS/Inficon	5 mbar full scale (linear)	0 - 10.00 VDC
54	MKS/Inficon	10 mbar full scale (linear)	0 - 10.00 VDC

Example: Change the Analog output emulation to MKS Baratron 0-10VDC with 0.1 Torr full scale:

Send: @254AOUT!10\

Reply: @253ACK10\

The DPP is available with a hardware optional secondary analog output. The output can be configured to the same output curves as the primary analog output.

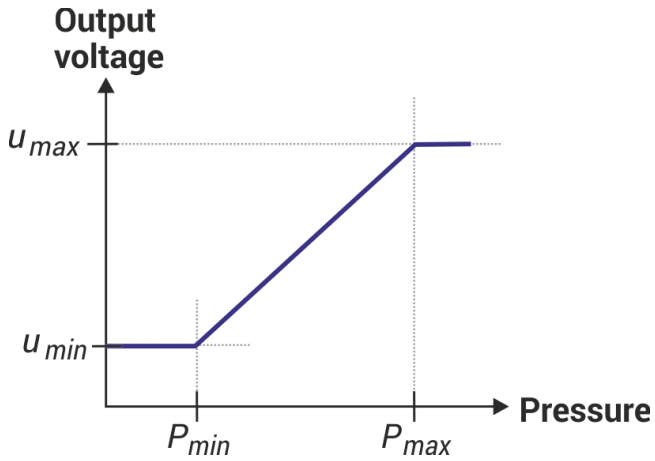
Example: Change the Analog output emulation to Pfeiffer TTR101 analog output:

Send: @254AOUT!2,35\

Reply: @253ACK2,35\

Programmable linear analog output (AO)

When selecting Aout to "Linear" the analog output configuration can be user configured to any linear scaling within the DPP measuring range and output limitation. This feature allows magnification of a specific pressure range.



Configuration of output:

When programming the voltage output scaling, the minimum and maximum output voltage must be entered in millivolt and the minimum and maximum pressure in transducer configured pressure unit.

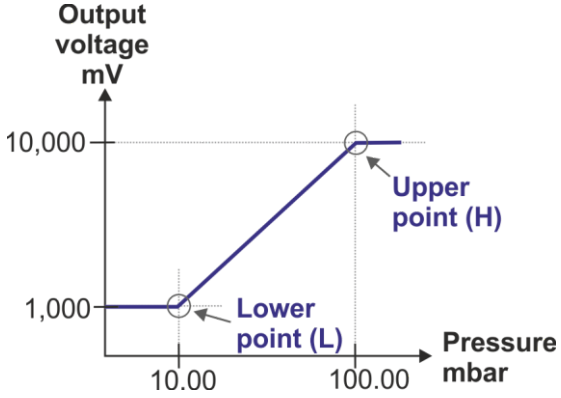
Command syntax:

AO!<Output1&2>, *<LOW PRESSURE VALUE>,<HIGH PRESSURE VALUE>,<LOW VOLTAGE VALUE>,<HIGH VOLTAGE VALUE>*

Example: Configure the analog 1 output linear expression between 1 VDC @ 10 mbar and 10 VDC @ 100 mbar.

Send: @254AO!1,10,1000,100,10000\

Reply: @253ACKAO
ANALOG OUT 1
: PRESSURE , AOUT [mV]
L : +1.00E+01, 1000
H : +1.00E+02, 10000\



Set Baud Rate (BAUD)

The DPP supports the following baud rates: 4800, 9600, 19.000, 38.400, 57.600, 115.200. Note that whenever the baud rate is changed, the DPP will send an acknowledgement to the BAUD command using the old baud rate setting before switching to the new one.

Example: Change the baud rate to 115.200:

Send: @254BAUD!115200\

Reply: @253ACK115200\

Button Enabled (BTN)

Enable or disable the feature to perform Pirani zero-adjustments and Differential Piezo zero-adjustments via the DPP's push-button.

Example: Disable the push-button.

Send: @254BTN!OFF\

Reply: @253ACKOFF\

LED Behavior (LED)

The DPP's LED can be programmed to work in three different ways during normal operation. See "Status LED" section for more details.

Parameter	Description
SOLID	The LED is solid green. (Factory default)
DYNAMIC	The LED changes color to reflect the measured pressure.
ANALOG	The LED changes color to reflect the 0-10V analog output.

Example: Have the LED change color as a function of the measured pressure.

Send: @254LED!DYNAMIC\

Reply: @253ACKDYNAMIC\

Sensor failure handling (FAIL)

The DPP can be configured to handle sensor failure in two different ways:

- Switch the Combined Pressure output (P? or P?CMB) and Analog Output to only use the working sensor, i.e. if the Piezo sensor is malfunctioning, the combined output is only based on the Vacuum Piezo and vice versa.
- Set both the Combined Pressure output and the Analog Output to zero in case of sensor errors to signal an error condition.

Parameter	Description
WORKING	Base Combined Pressure output and Analog Output on working sensor only.
FAIL	Set Combined Pressure output and Analog Output to 0 in case of sensor errors.

Example: Have the Combined Pressure output and Analog Output go to zero if a sensor is malfunctioning.

Send: @254FAIL!ZERO\

Reply: @253ACKZERO\

Pressure measurement (P)

The digital pressure measurement can be accessed using the S4-Connect™ programmer or RS-232/485 serial digital interface.

Reading the digital combined pressure value:

Send: @254P?\

Reply: @ACK1013.12\

Reading the digital Piezo pressure:

Send: @254P?PZ\

Reply: @ACK1013.12\

Reading the digital MEMS Pirani pressure:

Send: @254P?MP\

Reply: @ACK1.23E-3\

Quick data acquisitions (Q)

The quick data acquisition command provides all variable measurement data and setpoint status in one string.

Reading the quick data acquisition:

Send: @254Q?\

Reply: @ACK1.0000E-2,1.2300E-2,1.2300E-2,23.24,101\

Configuration of the quick data acquisition:

Send: @254Q!,PZ,PIR,CMB,SP,TEMP\

Reply: @ACK1.0000E-2,1.2300E-2,1.2300E-2,23.24,101\

Read the currently configured Q-configuration:

Send: @254Q?CONFIG\

Reply: @ACKPZ,PIR,CMB,SP,TEMP\

Parameters	Describtion
PZ	Piezo pressure measurement
PIR	Pirani pressure measurement
CMB	Combined pressure measurement
TEMP	Temperature measurement
SP	Setpoint status

Setpoint status

The setpoint status value provides a 3-digit value, where each digit represents the status of the setpoint relay
1, 2 and 3, respectively. Each digit may be 1=Energized relay, 0=De-energized relay, X=No relay installed.

Temperature measurement (T)

The DPP has a built-in high-resolution precision temperature sensor that provides a temperature measurement of the vacuum gas in degrees Celsius with a typical accuracy of better than ±1 °C.

Reading the temperature:

Send: @254T?\

Reply: @ACK25.22\

Unit (U)

The DPP can be configured to three different pressure units and three different temperature units. If no explicit parameter (pressure, temperature) is defined, pressure is assumed.

Setting pressure unit to Pascal:

Send: @254U!PASCAL\

Reply: @ACKPASCAL\

Setting pressure unit to mbar:

Send: @254U!P,MBAR\

Reply: @ACKMBAR\

Setting temperature unit to Fahrenheit:

Send: @254U!T,FAHRENHEIT\

Reply: @ACKFAHRENHEIT\

Reading current temperature unit:

Send: @254U?T\

Reply: @ACKFAHRENHEIT\

Pressure unit		
mbar	Pascal	torr

Temperature unit		
Celsius	Fahrenheit	Kelvin

Statistics (STAT)

The statistics function logs the number of operation hours and the maximum and minimum measured pressure or temperature value. If no explicit parameter (pressure, temperature) is defined, pressure is assumed.

Reading the statistics (parameter is left out, so pressure is assumed):

Send:	@254STAT?\
Reply:	@254ACKSTAT<cr> MIN : 5.6104E+00<cr> MAX : 1.0159E+03<cr> HOURS : 37\

Reading the temperature statistics:

Send:	@254STAT?T\
Reply:	@254ACKSTAT<cr> MIN : 2.345E+01<cr> MAX : 3.123E+01<cr> HOURS : 37\

Clearing the statistics (parameter is left out, so pressure is assumed):

Send:	@254STAT!CLEAR\
Reply:	@254ACKCLEAR\

Switch function (Optional)

The solid-state setpoint relay function can be used for controlling and surveillance by external equipment. The three independent solid-state switch relays can be used for external control of pumps, valves, safety interlock circuits and other external equipment. The basic control uses on/off regulation with a programmable setpoint and hysteresis value. Each solid-state relay offers both normally closed and normally open contacts. Solid-state relays are a hardware option that must be specified when ordering the transducer.

Compared to electro-mechanical relays, the solid-state relays offer superior reliability and faster switching time while providing arc free contacts and generating no EMI (electromagnetic interference) when switching contacts.

The relays are UL listed, CSA recognized, and EN/IEC 60950-1 certified for maximum confidence when used to control critical vacuum processes and high-cycle applications.

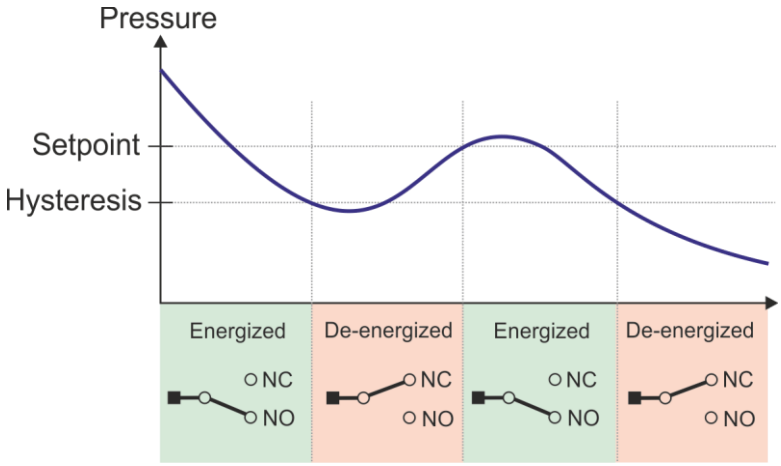
The relay switches are per default controlled by the pressure measurement but can also be configured to be controlled by the internal temperature sensor.

WARNING! Do not exceed maximum load rating of 250 mA, 50 VDC / VAC peak on relay contacts. Special precautions must be taken when driving an inductive load. Ensure that inrush peak current does not exceed relay contact ratings.

The switch can be configured to close the relay contact either above or below the setpoint value.

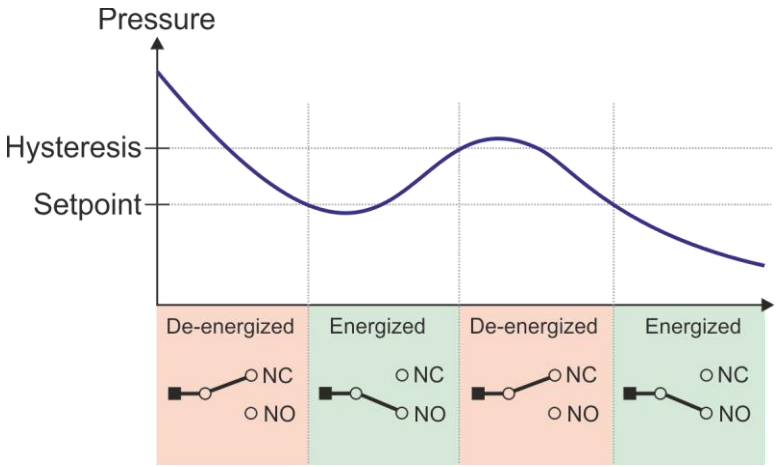
Above

When the switch direction is configured to above, the relay will remain energized (NO contact closed) until the hysteresis value is exceeded. Then it will change to de-energized (NC contact closed). The relay will energize (NO contact closed) again when the setpoint value is exceeded.



Below

When the switch direction is configured to below, the relay will remain de-energized (NC contact closed) until the hysteresis value is exceeded. Then it will change to energized (NO contact closed). The relay will de-energize (NC contact closed) again when the setpoint value is exceeded.



Configuration of setpoint

Setpoints can be configured either via the S4-Connect™ software or the command protocol.

INFORMATION: All values related to pressures like setpoint values and full-scale must be entered in the current unit for the transducer. When changing unit all setpoint values are converted to the new unit and consequently setpoint functionality will remain intact when changing unit.

Command sequence example:

@254SP?\ (This step is not mandatory.) Print an overview of all setpoint settings. If no setpoints have previously been defined, a DPP with three relays will produce the following overview.

```
#: ENABLE, ENERGIZED, SOURCE, DIRECTION, VALUE, HYSTERESIS<cr> 1:
OFF, NO, PRES, ABOVE, +0.000E+00, +0.000E+00<cr> 2: OFF, NO, PRES,
ABOVE, +0.000E+00, +0.000E+00<cr> 3: OFF, NO, PRES, ABOVE,
+0.000E+00, +0.000E+00<cr> \
```

@254SPS!1,P\ Assign pressure measurement as the source for Setpoint 1.

@254SPD!1,ABOVE\ Configure the Setpoint 1 relay to be energized whenever the pressure reading is greater than the Setpoint 1 value. Whenever this value is changed, the corresponding Hysteresis value is automatically calculated to either -10% of the current setpoint value (when direction = ABOVE) or +10% of the current setpoint value (when direction = BELOW). If the temperature measurement is selected as the source, the automatically calculated Hysteresis values will be -1°C /+1°C instead of -10%/+10%.

@254SPV!1,600\ Set the value of Setpoint 1 to 600 and auto-calculate Hysteresis value. As the direction is set to ABOVE, the hysteresis value will be automatically set to 540 (the setpoint value -10%). Had the direction been BELOW, the hysteresis would have been automatically set to 660 (the setpoint value +10%).

@254SPH!1,500\ Set the Hysteresis value for Setpoint 1 to 500.

@254SPE!1,ON\ Enable Setpoint 1.

@254SPR?1\ Get the current status of the Setpoint 1 relay

@254SP?\ (This step is not mandatory.) Print an overview of all setpoint settings to verify the new settings. If the unit is set to mbar and the pressure reading is above 600 - energizing the Setpoint 1 relay - - the generated output would look like this:

```
#: ENABLE, ENERGIZED, SOURCE, DIRECTION, VALUE, HYSTERESIS<cr>
1: ON, YES, PRES, ABOVE, +6.000E+00, +5.000E+00<cr>
2: OFF, NO, PRES, ABOVE, +0.000E+00, +0.000E+00<cr> 3: OFF, NO, PRES,
ABOVE, +0.000E+00, +0.000E+00<cr> \
```

Command	Description	Valid input
SPD	Setpoint Direction	<SETPOINT #>, <ABOVE, BELOW>
SPE	Setpoint Enable	<SETPOINT #>, <OFF/ON> <SETPOINT
SPH	Setpoint Hysteresis	#>, <PRESSURE VALUE> <SETPOINT #>,
SPV	Setpoint Value	<PRESSURE VALUE> <SETPOINT #>,
SPS	Setpoint Source (pressure or temperature)	<P/T>
SP	Read all setpoint settings	-

DPP Quantum

Product information and identification

The DPP has a serial number, product part number, manufacturer identity and firmware version programmed in its internal non-volatile memory.

Serial number:

Send: @254SN?\

Reply: @ACK191230123456;

Part number:

Send: @254PN?\

Reply: @ACKDPP-123456;

Manufacturer identity:

Send: @254MF?\

Reply: @ACKDIGIVAC;

Firmware version:

Send: @254FV?\

Reply: @ACK1.00;

Maintenance

Maintenance is not required in many applications during the lifecycle of this product. The calibration may shift during the life-time and re-calibration by adjusting the zero point and full-scale value can be performed by the user.

The DPP can be user configured, calibrated

and tested using the RS-232/485 interface.

Adjustment of the zero point

The DPP has an active and individual temperature compensation to account for zero-point drift. In many applications, a user adjustment of the zero point is not required during the lifetime of the product.

If drift of the zero-point is observed, it can be adjusted using the RS-232 / RS-485 communication interface or by pressing the zero switch.

Zero-point adjustment procedure using digital interface

1. Evacuate the transducer to a vacuum pressure below 1.00E-6 mbar.
2. Send command: @254VAC!\
3. Reply: @254ACK<value>\

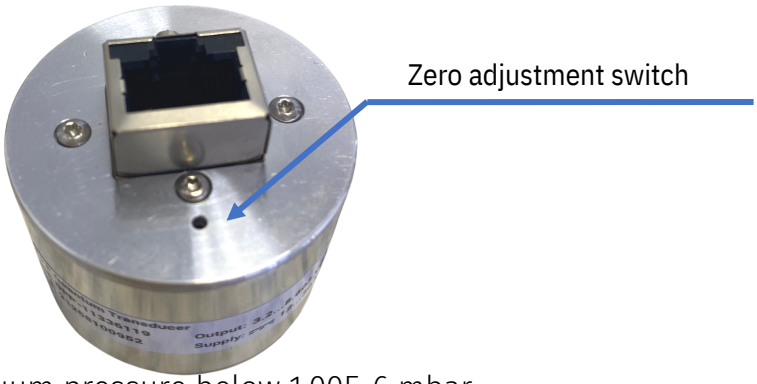
The reply <value> is the calculated offset pressure value as function of the factory default zero offset subtracted from the user offset adjustment.

If the recommended zero adjustment vacuum pressure cannot be achieved due to inadequate vacuum pumping capacity, the zero-point adjustment can be performed at a higher pressure by entering the actual pressure value measured by a reference transducer. Following command example will perform a zero adjustment at 5.00E-5 mbar:

1. Adjust the vacuum pressure to a known value
2. Send command: @254VAC!5.00E-5\
3. Reply: @254ACK<value>\

Zero-point adjustment procedure using the zero switch

The DPP can also be zero adjusted by pressing the zero adjustment switch using a tool with a maximum diameter of 1.5 mm.



1. Evacuate the transducer to a vacuum pressure below 1.00E-6 mbar.
2. Press the zero switch for 2 seconds
3. The LED will strobe green after completion of zero adjustment or red if the transducer is not able to perform zero adjustment.

Piezo sensor zero adjustment

The Piezo sensor is automatically zero-adjusted, whenever the pressure measured by the Pirani is lower than 1.00E-2 mbar (7.50E-3 Torr).

Adjustment of full-scale

Piezo sensor full-scale adjustment

The piezo sensor can be full-scale adjusted using the digital interface by the following procedure:

1. Expose the transducer flange to atmospheric ambient pressure
2. Obtain the actual atmospheric pressure (e.g. 1,013.1 mbar) from a reference gauge
3. Send the command: @254FS!PZ,1013.1\
3. Reply: @254ACK<value>\

The acknowledge value represents the scaling factor for the new piezo full-scale calibration. The full-scale adjustment can be executed in the pressure range 400-1,100 mbar (300-825 Torr).

Pirani sensor full-scale adjustment

The pirani sensor can be full-scale adjusted using the digital interface by the following procedure:

1. Expose the transducer flange to a Nitrogen pressure between 1 and 20 mbar
2. Obtain the actual pressure (e.g. 11.2 mbar) from a reference gauge
3. Send the command: @254FS!MP,11.2\
4. Reply: @254ACK<value>\

The Pirani sensor can also be full-scale adjusted by use of the internal piezo sensor as reference:

1. Expose the transducer flange to a Nitrogen pressure between 1 and 20 mbar
2. Send the command: @254FS!MP\
3. Reply: @254ACK<value>\

Resetting to factory default

The Factory Default command will reset all user settings to factory default, including setpoint settings, pressure unit and user-adjustment of zero point and full-scale.

DigiVac offers pre-configuration of user parameters, and if the product is delivered with a special user configuration, the factory default command will reset to the original user configuration as delivered.

Reset to factory default:

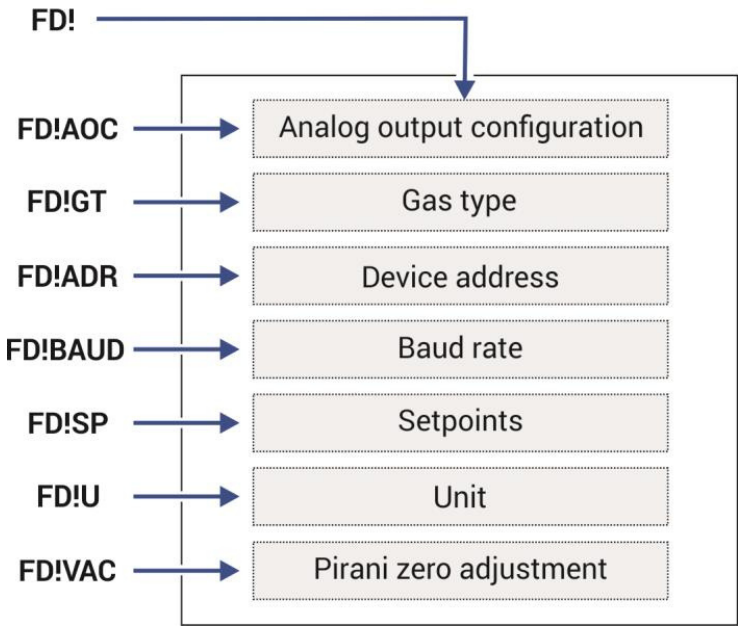
Send: @254FD!\
Reply: @ACKFD\

Parameter	Value
Vacuum zero adjustment	0
Full scale adjustment	1
Unit	As delivered
Baud rate	9600
Address	253
Analog output configuration	As delivered
Setpoint direction	Above or as delivered
Setpoint enable	OFF or as delivered
Setpoint hysteresis	As delivered
Setpoint value	As delivered
Setpoint source	Pressure

Individual reset to factory default

It is possible to reset only certain settings to their factory default values. This is done by adding an optional argument to the FD command. If the argument is left blank, all parameters will be reset to their default values.

Send: @254FD!<ARGUMENT>\
Reply: @ACKFD\



DPP Quantum

900 Series vacuum transducer compatibility

The DPP offers pin, analog output and digital communication protocol compatibility with the 901P, 925 and 910 vacuum transducers from MKS Instruments.

When using the 900 series communication protocol, the communication is based on an ASCII protocol that includes a start character, device address, command or query and an end character for termination:

@<device address><command or query><? or !><parameter>;FF

Start character: @

Device address: 001-253

Command: See command list

Query or set:

Parameter:

End characters: ;FF

Example of how to send a command to the transducer using the 900 Series protocol

Programming a setpoint value of 1.23E-4 (using the default unit setting of the transducer, e.g. mbar):

Send: @254SP1!1.24E-4;FF

Reply: @ACK1.23E-4;FF

The DPP supports following 900 Series commands:

Command	Description	Query	Set	Valid input parameter
AD	Communication address	X	X	3 digits (range 001-253)
AO1	Analog output configuration	X	X	STD, 0-39
BR	Set baud rate	X	X	4800, 9600, 19200, 38400, 57600, 115200 (default 9600)
FD	Factory default	X	X	ADR,AOC,FS,U,SP,VAC,<NONE>
FS	Full-scale adjustment	X	X	
FV	Firmware version	X		-
GT	Gas type	X	X	Nitrogen, Helium, Argon, Air
MF	Manufacturer	X		-
MD	Model name	X		-
PR1	Pressure measurement (Pirani)	X		-
PR2	Pressure measurement (Piezo)	X		
PR3	Pressure measurement (Combined)	X		
PN	Part number	X		-
SP1	Setpoint 1 value	X	X	<PRESSURE VALUE>
SD1	Setpoint 1 direction	X	X	ABOVE, BELOW
EN1	Setpoint 1 enable	X	X	OFF, ON
SH1	Setpoint 1 hysteresis	X	X	<PRESSURE VALUE>
SP1	Setpoint 1 value	X	X	<PRESSURE VALUE>
SD1	Setpoint 1 direction	X	X	ABOVE, BELOW
EN1	Setpoint 1 enable	X	X	OFF, ON
SH1	Setpoint 1 hysteresis	X	X	<PRESSURE VALUE>
SP1	Setpoint 1 value	X	X	<PRESSURE VALUE>
SD1	Setpoint 1 direction	X	X	ABOVE, BELOW
EN1	Setpoint 1 enable	X	X	OFF, ON
SH1	Setpoint 1 hysteresis	X	X	<PRESSURE VALUE>
SN	Serial number	X		-
T	Sensor temperature	X		-
U	Pressure unit	X	X	MBAR, PASCAL, TORR
VAC	Pirani Zero adjustment	X	X	No input or <PRESSURE VALUE>

Return

Before returning a product to DigiVac proper return forms and a return materials authorization (RMA) must be filled out. The RMA procedure can be found on: www.digivac.com/digivac-product-warranty-registration/

INFORMATION: DigiVac does not accept return of products without return materials authorization. DigiVac does not accept any return of products that have been exposed to or contaminated with radioactive, chemical, biological or other harmful or dangerous substances.

The DigiVac Company
1020 Campus Drive West
Morganville, NJ 07751

Phone: 732-765-0900
Fax: 732-765-1800
Email: orders@digivac.com

RMA – Return Material Authorization

This form should be filled out and enclosed with the package
Please contact DigiVac to obtain RMA # email: orders@DigiVac.com

Decontamination Form

You have requested authorization to process or return the following:

Model #:_____ **Serial #:**_____

PO#:_____ **Choose One: ☐Calibration☐Repair**

Before we can issue an agreement for return of the material identified above, the following must be filled out and signed by an informed and responsible member of your organization:
WAS THE PRODUCT EVER EXPOSED TO, OR DID IT EVER CONTAIN HAZARDOUS MATERIALS?
YES__ NO__
If yes, you must completely identify all materials, answer the following inquiries, and attach the appropriate MSDS forms:
( )Poisonous ( )Corrosive ( )Mercury ( )Radioactive ( )Oxidizer ( )Biological/ Infectious

( )Flammable ( )Carcinogen ( )Acetonitrile ( )Trichloroethylene ( )Copper ( )Other_____

Describe the Material Type:

_____

_____

HAS THE PRODUCT BEEN PROPERLY CLEANED SO THAT IT IS SAFE FOR HUMAN HANDLING?
YES_____ NO_____

ARE THERE ANY ADDITIONAL PRECAUTIONS THAT NEED TO BE TAKEN? **YES____ NO_____**

If yes, please describe in detail:

_____

_____

NAME:_____ **COMPANY:**_____

SIGNATURE:_____ **TITLE:**_____

DATE:_____ **PHONE#:**_____

RMA#:_____

The Digivac Company relies on the accuracy of your responses to protect the safety of our employees.
You must provide correct information.
Please fax the complete form to (732)-765-1800 or email to orders@digivac.com

Specifications

Specifications	
Measuring range in mbar	1×10^{-6} to 1333 mbar (7.5×10^{-7} to 1000 Torr)
Measuring principle 1×10^{-6} to 1.5 mbar	MEMS Pirani thermal conductivity
Measuring principle 1.5 to 2 mbar	Blended MEMS Pirani / piezo reading
Measuring principle 2 to 1,333 mbar	MEMS piezo resistive diaphragm
Accuracy(9) 7.5×10^{-6} to 7.49×10^{-5} Torr	50% of reading
Accuracy(9) 7.5×10^{-5} to 5.99×10 Torr	14% of reading
Accuracy(9) 6.0×10 to $7.43\times10^{+5}$ Torr	5% of reading
Accuracy(9) $7.5\times10^{+1}$ to 1000 Torr	2% of reading
Analog output resolution	16 bit (150 µV)
Analog output update rate	124 Hz
Response time (ISO 19685:2017)	<20 ms
Temperature compensation	+10 to +50 °C
Temperature measurement range	-40 to +80 °C
Temperature measurement absolute accuracy	±1.5 °C (0 to +80 °C)
Solid state relay set point range	5×10^{-6} to 1333 mbar (3.75×10^{-6} to 1000Torr)
Solid state relay contact rating	50 V, 100 mA_{rms} / mA_{DC}
Solid state relay contact on resistance	<35 Ω
Solid state relay contact endurance	Unlimited (no mechanical wear)
Solid state relay approvals	UL Recognized: File E76270 CSA Certified: Certificate 1175739 EN/IEC 60950-1 Certified

Environment conditions	
Operating ambient temperature	-20 to +50 °C
Media temperature	-20 to +50 °C
Storage ambient temperature	-40 to +120 °C
Bake-out temperature (non-operating)	+120 °C
Maximum media pressure	10 bar absolute(10)
Mounting position	Arbitrary
Protection rating, EN 60529/A2:2013	IP40
Humidity, IEC 68-2-38	98%, non-condensing
Power supply	
Supply voltage	12-30 VDC
Power consumption	350 mW (max)
Reverse polarity protection	Yes
Overvoltage protection	Yes
Internal fuse	100 mA (thermal recoverable)

(9) Accuracy and repeatability specifications are typical values measured at ambient temperature in Nitrogen atmosphere after zero adjustment.

(10) Refer also to maximum pressure rating for the used fittings.

DPP Quantum

Materials	
Enclosure	SS 1.4307 / AISI 304L / Aluminum 6061
Vacuum flange (media wetted)	SS 1.4307 / AISI 304L
Vacuum exposed materials (media wetted)	AISI 304L Stainless steel, Kovar, glass, silicon, nickel, aluminum, SiO2, Si3N4, gold, Viton®, low out-gassing epoxy resin, solder, RO4305
Process leak tightness	<1·10-9 mbar·l/s
Enclosure	AISI 304L / Aluminum 6061
Approvals	
CE	Directive 2014/30/EU
RoHS compliance	Directive EU 2015/863
REACH compliance	Directive 1907/2006/CE

DigiVac
Scientific Measurement & Control

Declaration of Conformity

This declaration of conformity has been made in accordance with EN ISO/IEC 17050-1:2010

Manufacturer:	DigiVac
Address:	1020 Campus Dr NJ 07751, Morganville USA

We hereby declare under our sole responsibility that the following products:

Product description:	Vacuum Pressure Transducer
Product part number:	DPP-xxxxxxxx

Complies with the requirements of following relevant European Union harmonization directive:

Electromagnetic Compatibility (EMC) Directive 2014/30/EU

RoHS Directive EU 2015/863

Conformity is assessed in accordance to the following standards:

Reference: Date	Title
EN61326-1: 2021	Product family standard, Measurement, control and laboratory equipment
EN 61326-2-3:2021	Test configuration, operational conditions and performance criteria for transducers with integrated or remote signal conditioning
EN 61000-3-2:2006 + A1:2009 and A2:2009	Limits for harmonic current emissions
EN 61000-3-3:2008	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems
EN 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Signed on behalf of:	DigiVac
Place of issue:	Morganville, NJ, USA
Date of issue:	August 10th ,2021
Signature:	
Name, Title	Tim Collins, Chief Executive Officer

Questions & support

For more information visit:

www.DigiVac.com

The DigiVac Company
1020 Campus Drive West
Morganville, NJ 07751
Phone: 732-765-0900
Fax: 732-765-1800
Email: support@digivac.com

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