DECLARATION OF DOMENIC RIZZOLO

1. I, Domenic Rizzolo, submit this Declaration on behalf of the Patent Owner, Provisur Technologies, Inc. ("Provisur"). I am a citizen of the United States, over 18 years of age, and competent to testify to the matters contained in this Declaration. If called as a witness, I could and would competently testify to these same facts.

BACKGROUND & QUALIFICATIONS

2. I am currently employed as a Manager in Aon's Stroz Friedberg Digital Forensic and Incident Response team ("Stroz Friedberg"). I have been employed at Stroz Friedberg since September 2015. My CV attached as Exhibit A.

3. At Stroz Friedberg, I frequently conduct forensic examinations on a variety of computers and other digital media, advising in civil litigation and incident response cases. Specifically, my consultations have included the retrieval, preservation, and analysis of a variety of electronic evidence in order to present facts and opinions.

4. I attended the University of Michigan where I received a Bachelor's Degree in Mathematics. I have multiple certifications in computer forensics and other information security fields.

RETENTION AND ASSIGNMENT

5. Stroz Friedberg was retained by Provisur, under the direction of Willkie Farr & Gallagher LLP, to preserve a webpage and a document linked on that webpage.

6. I preserved the webpage and linked document on December 4, 2023. A true and accurate copy of the original evidence was captured.

PRESERVATION

7. I preserved the webpage residing at the following URL: https://web.archive.org/web/20150418111911/http://www.omega.com/pptst/PXM409.html ("the webpage").

8. I preserved the webpage by accessing its URL via version 119.0.6045.200 of the Google Chrome web browser on December 4, 2023. Upon accessing the webpage, I used multiple built-in functionalities of the Google Chrome web browser to capture the content of the webpage. I used all three settings of the "Save Page As..." feature within Google Chrome to capture the data that comprised the webpage. The resulting downloaded iterations of the webpage were preserved as it would appear to a Google Chrome user.

9. I used the "Webpage, HTML Only (*.html; *.htm)" setting of the "Save Page As..." feature to preserve the webpage on December 4, 2023, at 21:14:31 UTC[1]. This preservation captured the contents of the webpage in a single ".html" file of size 223,785 bytes.

10. I used the "Webpage, Single File (*.mhtml)" setting of the "Save Page As..." feature to preserve the webpage on December 4, 2023, at 21:14:45 UTC. This preservation captured the contents of the webpage in a single ".mhtml" file of size 740,545 bytes. A true and correct copy of this preserved webpage, converted to a PDF, is attached here as Exhibit B.

11. I used the "Webpage, Complete (*.html; *.htm)" setting of the "Save Page As..." feature to preserve the webpage on December 4, 2023, at 21:16:25 UTC. This preservation captured the contents of the webpage and its associated elements in 79 separate files that sum to a total size of 2,225,936 bytes.

12. The Internet Archive, also known as the Wayback Machine, is a website residing at the following URL: "https://web.archive.org/". The Internet Archive is a 501(c)(3) non-profit

[1] All dates in this declaration are recorded in Universal Coordinate Time ("UTC") unless otherwise noted. Some timestamps have been converted to UTC from their original time zones.

focused on building a digital library of Internet sites and other cultural artifacts in digital form. The site provides free access to researchers, historians, scholars, the print disabled, and the general public. The archive has been preserving stateful copies of billions of webpages for over 25 years[2].

13. Since the Wayback Machine can snapshot the same webpage across multiple days and years, the naming convention of a given URL from the Wayback Machine includes a date code embedded in the archived URL which indicates when a particular version of the webpage was archived by the Wayback Machine's web crawler. These date codes include a date and timestamp in the UTC time zone.

14. Based on the disclosed formatting style of the Wayback Machine's date codes, I discerned that the embedded date code associated with the webpage, "20150418111911", correlated with a preservation timestamp of March 18, 2015, at 11:19:11 UTC.

15. Additionally, the webpage contained a link labelled "Specs" to a PDF file, named "PXM409.pdf". Due to the iterative nature of the Wayback Machine's webpage crawler, a copy of this file was snapshotted and is accessible via the URL "https://web.archive.org/web/20150418111911/http://www.omega.com/Pressure/pdf/PXM409.pdf" which redirects to a second Wayback Machine URL of "https://web.archive.org/web/20151017134840/http://www.omega.com/pressure/pdf/PXM409.pdf" ("the PDF webpage"). I preserved the underlying PDF file by accessing the PDF webpage via version 119.0.6045.200 of the Google Chrome web browser on December 4, 2023.

[2] See https://archive.org/about/ for further information about the Internet Archive.

16. The resulting, preserved PDF was a file named "PXM409.pdf" of size 809,363 bytes ("the PDF file"). The PDF file has a SHA1 cryptographic hash value of 7aaa340fdcf5288b91eed4fe177c46781e291a88[3].

17. A true and correct copy of this PDF file is attached here as Exhibit C.

18. The date code of the PDF webpage's Wayback Machine URL was "20151017134840", which was different than that associated with the webpage. Based on the disclosed formatting style of the Wayback Machine's date codes, I discerned that the embedded date code associated with the PDF webpage correlated with a preservation timestamp of October 17, 2015, at 13:48:40 UTC.

19. "Metadata" refers to "data about data," as distinguished from the visual or interactive content of the document being analyzed. This may include information such as the original creation date of a document, or names of the original creators. Internal metadata refers to the specific set of metadata stored within a file's contents, rather than externally such as metadata stored in a computer's filesystem or operating system. In this case the internal metadata was metadata specific to the ".PDF" file format.

20. I extracted internal metadata using the publicly available metadata extraction tool "exiftool" against the PDF file. The PDF file's "Create Date" attribute was set to January 16, 2015, at 20:48, while both its "Metadata Date" and "Modify Date" attributes were set to January 20, 2015, at 16:10:10.

21. The version history of the PDF file embedded within the file's metadata recorded 51 version history events for the PDF file, ranging from a "Creation" event on May 25, 2012, at

[3] The SHA1 algorithm is one of many publicly-established mathematical functions commonly used to establish file integrity and uniqueness via cryptographic hashing resulting in a hexadecimally-formatted numerical output.

17:26:33 UTC to the most recent "Saved" event on January 15, 2015, at 19:42:57 UTC. These events track the history of the document preceding its most recent version.

22. Under penalties of perjury, I declare that the foregoing Declaration and the facts stated in it are true and correct.

By: Domenic Rizzolo

Name: Domenic Rizzolo

Title: Manager, Stroz Friedberg

Date: 2023-12-06

CHRISTINA GOEDAR
OFFICIAL SEAL
Notary Public, State of Illinois
My Commission Expires
August 24, 2026

Christina Goedar

Christina Goedar

Commission # 881221

Exhibit A

CURRICULUM VITAE

Domenic Rizzolo

Manager

+1 312 646 7352
domenic.rizzolo2@aon.com
200 East Randolph Street, Floor 10, Chicago IL, 60601

PROFESSIONAL EXPERIENCE

Stroz Friedberg, an Aon Company
Manager, April 2020 to present
Chicago, IL

Manage Chicago, formerly Minneapolis, forensic lab and directly supervise forensic and incident response examiners. Conduct digital forensic acquisitions and examinations of laptops, desktops, and other digital storage media in civil litigations, criminal matters, and internal investigations. Conduct significant breach investigations. Utilize various open-source and proprietary analysis tools to identify attacker presence and impact. Identify data exfiltration through forensic host analysis, memory analysis, and active SIEM and IDS monitoring. Preserved and analyzed data from laptops, desktop computers, servers, and mobile devices. Identify clients' risk related to internal IT infrastructure, publicly available IT assets, and other relevant attack surfaces.

Senior Consultant, April 2018 to May 2020
Consultant, June 2016 to April 2018
Cyber Associate, September 2015 to May 2016

Duo Security
Security Researcher, Labs Division & Office of the CTO, April 2014 to April 2015
Ann Arbor, MI

Contributed to special projects, assessments, and creation of strategic surprise in daily collaboration with CTO and Duo Labs research team. Created and refined content drawing 5,000+ unique viewers to the company website. Assisted in vulnerability research, cataloging, and disclosure; developed code in collaboration with Engineering, Product, and Marketing; published internal threat assessments.

Levy Restaurants: Park View at Ravinia Festival
Lead Server and Caterer, Summer 2012 to Summer 2013
Highland Park, IL

University of Michigan
Research Assistant on "The Cyberwar History Project", September 2012 to May 2013
Ann Arbor, MI

Researched and analyzed scholarly articles, tracked findings in database, interpreted and analyzed metadata, extrapolated trends. Other projects included presenting findings at annual University Research Symposium

Vector Marketing
Personal Sales Associate, Summer 2011
Northbrook, IL

About: Aon's Cyber Solutions offers holistic cyber risk management, unsurpassed investigative skills, and proprietary technologies to help clients uncover and quantify cyber risks, protect critical assets, and recover from cyber incident.

Cyber security services offered by Stroz Friedberg Inc. and its affiliates. Insurance products and services offered by Aon Risk Insurance Services West, Inc., Aon Risk Services Central, Inc., Aon Risk Services Northeast, Inc., Aon Risk Services Southwest, Inc., and Aon Risk Services, Inc. of Florida and their licensed affiliates.

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Empower Results®

EDUCATION

University of Michigan, Ann Arbor, Michigan
Bachelors of Science, Mathematics - Discrete and Algorithmic Methods, May 2015

Certifications

GIAC Defending Advanced Threats (GDAT) 2020. Global Information Assurance Certification

GIAC Certified Forensic Analyst (GCFA), 2019-2023. Global Information Assurance Certification

GIAC Network Forensic Analyst (GNFA), 2018. Global Information Assurance Certification

GIAC Certified Forensic Examiner (GCFE), 2015-2023. Global Information Assurance Certification

Training

Stroz Friedberg Internal Cyber Training Program: Participate in regular in-house training presentations on current digital forensics, cybercrime response, computer security, desktop, and network forensic tools in conjunction with relevant legal and industry matters. Lead advanced training for annual associate classes.

SANS DFIR, Forensics 509: Enterprise Cloud Forensics and Incident Response. Attended week-long training with focus on cloud hosting infrastructure, digital forensic processes in cloud computing environments, and responding to threats against enterprise cloud environments.

SANS DFIR, Security 599: Defeating Advanced Adversaries - Purple Team Tactics & Kill Chain Defenses. Attended week-long training with focus on advanced attack techniques and corresponding system defenses.

SANS DFIR, Forensics 508: Advanced Incident Response, Threat Hunting, and Digital Forensics. Attended week-long training on enterprise incident response and forensics.

SANS DFIR, Forensics 572: Advanced Network Forensics. Attended week-long training focused on evidence collection and analysis of computer networks.

SANS DFIR, Security 504: Hacker Tools, Exploits, and Incident Handling. Attended week-long training focused on incident response and network intrusion techniques.

SANS DFIR, Forensics 408: Windows Forensic Analysis, September 2015 Attended week-long training on in-depth forensic analysis of Windows operation systems.

Lectures and Presentations

Winter Semester 2016, 2017, 2018, 2020, 2021, 2022, 2023: Guest Lecture presentation "Introduction to Forensics", at Loyola University Chicago class on Electronic Discovery Law & Problem Solving

August 2014: Presented on "Hacker Community and Culture", at BSides InfoSec Conference, Las Vegas, NV

May 2017: Guest Lecture presentation "Digital Forensics & Incident Response", at DePaul University

February 2018: Guest Lecture presentation "Simplified Kill Chain: Actor Sophistication" at Northwestern University class "COMP_SCI 355: Digital Forensics and Incident Response"

May 2018: Presented on "Family-Style Incident Response" at BSides Chicago Conference

September 2018: Presenter on "What Keeps You Up at Night" roundtable at Washington University in St. Louis

Awards and Recognition

SANS Institute "DFIR Netwars" Individual Event Winner, December 2020

SANS Institute "DFIR Netwars" Team Event Winner, December 2017 & 2018

Michigan Traditions Scholarship for Notable Academic Achievement, University of Michigan, 2012 - 2015

Paul Taylor Award for Most Valuable Member, University of Michigan Men's Glee Club,

Llangollen Award for Tradition, Camaraderie, and Musical Excellence, University of Michigan Men's Glee Club,

Youth Leadership Award, Archdiocese of Chicago Vicariate II,

The Wayback Machine - https://web.archive.org/web/20150418111911/http://www.omega.com/pptst/PXM409.html

High (0.08%) Accuracy Metric Pressure Transducers

PXM409

High Accuracy Metric Pressure Transducers



$475.00 PXM409-350HGV

PLACE ORDER

- 5-Point Agency Traceable Calibration Included
- Metric Pressure Ranges
- G 1/4 Thread Standard
- 0 to 100 mV, 0 to 10 Vdc, or 4 to 20 mA Outputs
- Gauge, Compound Gauge, Absolute, Vacuum and Barometric Pressure Ranges Available
- Welded Stainless Steel Construction
- 316 Stainless Steel Wetted Parts
- Premium Temperature Performance
- Broad Compensated Temperature Range
- Ruggedized with Secondary Containment

View related products - Pressure Transducers

Scroll below To Order | Specs | Related Products | Printer Friendly

Omega's high accuracy piezoresistive pressure transducers have a proven record in high performance commercial and aerospace applications for over 25 years. The piezoresistive process uses strain gages molecularly embedded into a highly stable silicon wafer. The silicon wafer is diced into individual die which each contain a full strain gage bridge. The die is mounted in a sealed chamber protected from the environment by glass to metal seals and a stainless steel diaphragm.

A small volume of silicone oil transfers the pressure from the diaphragm to the strain bridge. The construction provides a very rugged transducer with exceptional accuracy, stability and thermal effects. A unique design ruggedizes the transducers by providing secondary fluid containment in the event of a diaphragm rupture.

At our state-of-the-art facilities, automated test equipment performs pressure and temperature cycling on 100% of the PX409 transducers. The transducers are then calibrated using extremely high accuracy equipment and a 5-point NIST traceable calibration certificate is included with each transducer. The inherent stability of the piezoresistive core provides excellent long term stability, repeatability and very low thermal effects at the price of much lower performance transducers. Standard features of the PX409 Series also include protective features built into the electronics and the pressure element. Reverse polarity, EMC, and power supply fluctuation protection are standard on all models. For Intrinsically Safe and CSA ratings see model PXM509.

The most popular ranges and configurations are stocked for immediate delivery. All others typically have very short lead-time.



PRESSURE TRANSDUCER CONFIGURATOR

Still can't find the right model? Specify the perfect transducer for your application with this easy, step-by-step configurator.

The PXM409 is also available in standard/imperial configurations, with NPT ports, and models from 0-10 inH2O to 0-5,000 psi pressure ranges. Please see the PX409 for complete details, or contact our Pressure department for more information..

SPECIFICATIONS
Accuracy: Standard ±0.08% FS, BSL, Linearity, Hysteresis and Repeatability Combined

(compound ranges calibrated only in positive direction)
Operating Temperature:
mV/V Output: -45 to 121°C (-49 to 250°F)
Amplified Output: -45 to 115°C (-49 to 239°F)
Compensated Temperature Range:
25 to 350 mB: -18 to 85°C (0 to 185°F)
1 to 350 bar: -29 to 85°C (-20 to 185°F)
Thermal Accuracy: % span shift over compensated temperature range
25 to 350 mB:
Zero: ±1.0% max
Span: ±1.0% max
1 to 350 bar:
Zero: ±0.50% max
Span: ±0.50% max
ROHS Compliant
Minimum Isolation Between Case and Terminations: 100 MΩ @ 50 Vdc
Pressure Cycles: 1 million, minimum
Long Term Stability (1-Year): ±0.1% FS typical
Shock: 50 g, 11 ms half sine shock, Vertical and Horizontal
Vibration: 5-2000-5 Hz 30 minute cycle, Curve L, Mil Spec 810 figure 514-2-2, Vertical and Horizontal
Bandwidth: DC to 1 kHz typical
Response Time: <1 ms
CE Compliant: Industrial Level
Emissions: IEC550022 Class B
Electrostatic Discharge Immunity: IEC1000-4-2
EM Field Immunity: IEC61000-4-3
EFT Immunity: IEC61000-4-4
Surge Immunity: IEC61000-4-5
Conducted RF: IEC610000-4-6
Rate Power Frequency Magnetic Field: IEC61000-4-8
Environmental Protection:
PXM409: IP67
PXM419: IP65 gauge, IP67 Abs
PXM459: IP65 gauge, IP67 Abs
Proof Pressure Gauge/Vac/Compound:
25 mB: 10 times span
70 mB: 6 times span
170 mB to 100 bar: 4 times span
175 to 350 bar to 500 bar max
Proof Pressure Absolute:
350 mB to 100 bar: 4 times span
175 to 350 bar: to 500 bar max
Secondary Containment;
Gauge/Vac/Compound:
25 to 350 mB: to 70 bar
1 to 70 bar: to 200 bar
100 to 350 bar: to 700 bar
Absolute/Barometric:
350 mB: to 70 bar
1 to 70 bar (includes barometric ranges): to 200 bar
100 to 350 bar: to 700 bar
Wetted Parts: 316L SS
Electrical Terminations
PXM409: 2 m (6.6') cable
PXM419: mini DIN with mating connector
PXM459: M12 4-pin
Pressure Port: G1/4
Weight: 115 to 200 gm depending upon configuration
Electrical Outputs:
mV/V Output:
Output: 10 mV/V ratiometric
Supply Voltage: 5 to 10 Vdc (5 mA @ 10 Vdc)
Zero Balance:
Ranges > 170 mB: ±0.5% typ. (1% max)
Ranges ≤ 170 mB: ±1% typ. (2% max)
Span Setting:
Ranges > 170 mB: ±0.5% typ. (1% max)
Ranges ≤ 170 mB: ±1% typ. (2% max)
Input/Outut Resistance: 5000 Ω ±20%
Voltage Output:
Output: 0 to 10 Vdc
Supply Voltage:15 to 30 Vdc @ 10 mA (±10 Vdc or compound)
Zero Balance:
Ranges > 170 mB: ±0.5% typ. (1% max)
Ranges ≤ 170 mB: ±1% typ. (2% max)
Span Setting:
Ranges > 170 mB: ±0.5% typ. (1% max)
Ranges ≤ 170 mB: ±1% typ. (2% max)
Current Output:
Output: 4 to 20 mA (zero pressure = 12 mA on compound ranges)
Supply Voltage: 9 to 30 Vdc (9 to 20 Vdc above 105°C) max loop resistance = (Vs-9) x 50 O
Zero Balance:
Ranges > 170 mB: ±0.5% typ. (1% max)

Ranges ≤ 170 mB: ±1% typ. (2% max)
Span Setting:
Ranges > 170 mB: ±0.5% typ. (1% max)
Ranges ≤ 170 mB: ±1% typ. (2% max)

The table below features models with 10 mV/V ratiometric outputs.
To order 4-20 mA output change the suffix "V" to an "I"
To order 0-10 Vdc output change the suffix "V" to an "10V"
Or see the Part Number Builder below the table to order all models.

To Order (Specify Model Number)

ADD TO CART +

What Other People Bought: When you see this icon, click on it to expand a list of products that other people have bought when they purchased this model.

Part Number	Availability	Price	Description	Qty.
Gauge Pressure Models				
PXM409-001BGV	1 Week	$475.00	1 bar gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-010BGV	1 Week	$475.00	10 bar gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-350BGV	In Stock	$475.00	350 bar gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-100BGV	1 Week	$475.00	100 bar gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-350HGV	1 Week	$475.00	350 mbar gauge pressure high accuracy transducer, mV/V output, cable connection	0
Absolute Pressure Models				
PXM409-350HAV	In Stock	$495.00	350 mbar absolute pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-002BAV	1 Week	$495.00	2 bar absolute pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-010BAV	1 Week	$495.00	10 bar absolute pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-245BAV	1 Week	$495.00	245 bar absolute pressure high accuracy transducer, mV/V output, cable connection	0
Vacuum (Negative Gauge) Pressure Models				
PXM409-025HVV	1 Week	$600.00	25 mbar vacuum (negative gauge) pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-070HVV	1 Week	$600.00	70 mbar vacuum (negative gauge) pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-170HVV	1 Week	$600.00	170 mbar vacuum (negative gauge) pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-350HVV	1 Week	$550.00	350 mbar vacuum (negative gauge) pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-001BVV	1 Week	$550.00	1 bar vacuum (negative gauge) pressure high accuracy transducer, mV/V output, cable connection	0
Compound Gauge Pressure Models				
PXM409-025HCGV	1 Week	$665.00	±25 mbar compound gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-070HCGV	In Stock	$665.00	±70 mbar compound gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-170HCGV	1 Week	$665.00	±170 mbar compound gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-350HCGV	1 Week	$665.00	±350 mbar compound gauge pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-001BCGV	1 Week	$615.00	±1 bar compound gauge pressure high accuracy transducer, mV/V output, cable connection	0
Barometric Pressure Models				
PXM409-1100HBV	In Stock	$625.00	0 to 1100 mbar barometric pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-550HBV	1 Week	$625.00	550 to 1100 mbar barometric pressure high accuracy transducer, mV/V output, cable connection	0
PXM409-880HBV	1 Week	$625.00	880 to 1100 mbar barometric pressure high accuracy transducer, mV/V output, cable connection	0
Accessories				
CX5302	In Stock	$15.00	Replacement micro mini DIN connector for PXM419, 4 contacts on 9.4 mm (0.37') spacing with PG7 gland	0
CX5303	In Stock	$25.00	Micro mini DIN connector, 4 contacts on 9.4 mm (0.37') spacing with 1?2' conduit fitting	0

M12C-PVC-4-S-F-5	In Stock	$15.50	PVC cable, straight 4-pin M12 female connector one end, flying leads one end, 5 m (16') long	0
M12C-PVC-4-S-F-10	7 Weeks	$18.50	PVC cable, straight 4-pin M12 female connector one end, flying leads one end, 10 m (32') long	0
Compatible Panel Meters				
DP25B-S	In Stock	$250.00	4-digit strain meter for mV/V transducers	0
DP25B-E	In Stock	$250.00	4-digit process meter for 10V or 4 to 20 mA transducers	0
DP41-B	In Stock	$525.00	6-digit process meter for 10V or 4 to 20 mA transducers	0

ADD TO CART +

† *All dollar amounts on this site are shown in US currency.*

Note: All models come with a NIST traceable calibraton certificate.
Ordering Example: (1) **PXM409-007BGV** 0.08% accuracy, G 1/4 Th'd, 7 bar range, 10 mV/V output, cable termination, **$475.00**

Part Number Builder

	(1)	(2)	(3)	(4)
PXM4	0	**9-** 025H	G	V

Qty: 1

Option Descriptions
(1)Electrical Termination
Select
0 for 2m cable
1 for mini DIN
5 for M12 4-pin male connector
(2)bar Range - Not all ranges are available for every pressure type
Select
025H for 25 mbar
070H for 70 mbar
170H for 170 mbar
350H for 350 mbar
1100H for 0 to 1100 mbar (barometric models only)
550H for 550 to 1100 mbar (barometric models only)
880H for 880 to 1100 mbar (barometric models only)
001B for 1 bar
002B for 2 bar
3.5B for 3.5 bar
007B for 7 bar
010B for 10 bar
17.5B for 17.5 bar
035B for 35 bar
050B for 50 bar
070B for 70 bar
100B for 100 bar
175B for 175 bar
245B for 245 bar
350B for 350 bar
(3)Pressure Type
Select
G for Gauge
A for Absolute
V for Vacuum
CG for Compound Gauge
B for Barometric
(4)Output
Select
V for 10 mV/V
10V for 0 to 10 Vdc
I for 4 to 20 mA
NOTE: All combinations may not be valid, check spec sheet for valid part numbers.

Related Links - Related Products

Related Products



PX409 Gage and Absolute Pressure:
PX409 Series High Accuracy Pressure Transducers
Now with 0.05% Accuracy and 0.03% Linearity Options



DP41-S:

High Performance Strain Gage Meter, High Resolution 6-Digit Display

Keywords:High Accuracy Metric Pressure Transducers Metric Pressure Transducer Metric Pressure Ranges PXM409, electrical panel meters limit switch circuit negative temperature coefficient thermistor pressure level measurement

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PRECISION MICRO-MACHINED SILICON TRANSDUCERS AND TRANSMITTERS

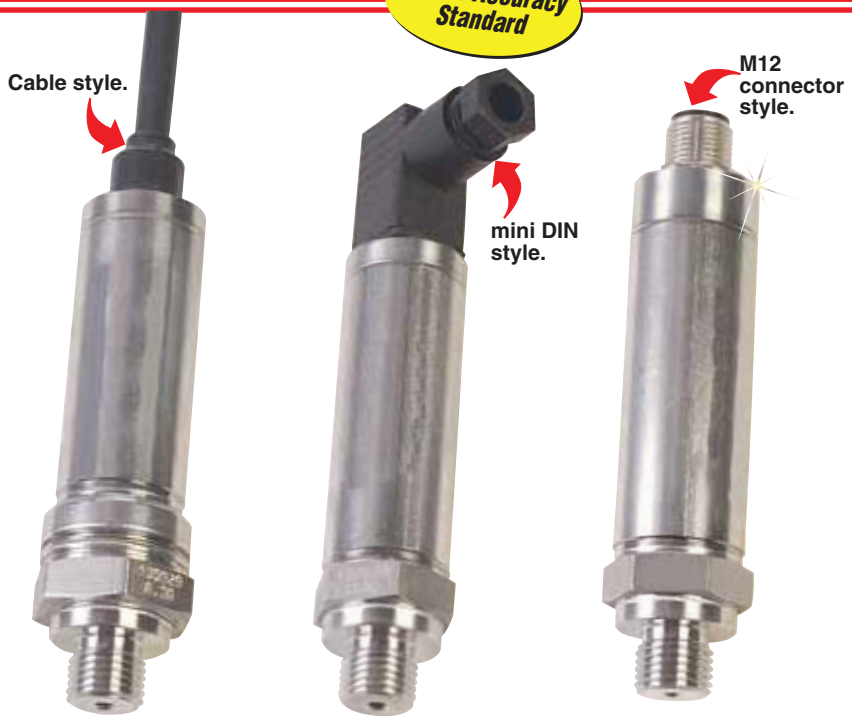
Gauge Pressure, Absolute, Vacuum, Compound and Barometric Ranges
±25 mbar to 0-350 bar Ranges
10 mV/V, 0 to 10 Vdc or 4-20 mA Outputs

0.08% Accuracy Standard

PXM409 Series

CAL CERT CE RoHS

- **5-Point Agency Traceable Calibration Included**
- **Gauge, Compound Gauge, Absolute, Vacuum and Barometric Pressure Ranges Available**
- **Welded Stainless Steel Construction**
- **316 SS Wetted Parts**
- **Premium Temperature Performance**
- **Broad Compensated Temperature Range**
- **Ruggedized with Secondary Containment**



PXM409-001BGV, shown smaller than actual size.

PXM419-007BGI, shown smaller than actual size.

PXM459-002BAV, shown smaller than actual size.

durable, precision transducers. Their standard accuracy is a high industrial grade accuracy of 0.08%. The modular construction allows for fast delivery of most models (typically 2-week maximum). Models are available with gauge (relative), compound gauge, absolute, vacuum (negative gauge) and barometric pressure ranges.

The PXM409 Series use a micro-machined piezoresistive silicon element for high accuracy and all stainless steel wetted parts for durability and superior chemical compatibility. Their high accuracy combined with very high thermal compensation (0.7% Typ.) over the compensated range make the PXM409 series ideal for scientific or industrial applications requiring a rugged, high accuracy transducer with very low thermal drift. They can be used in test benches, laboratory testing, engine testing, ground test stations and other industrial applications requiring

SPECIFICATIONS

Accuracy: Standard ±0.08% FS, BSL, linearity, hysteresis and repeatability combined (compound ranges calibrated only in positive direction)

Operating Temperature:

mV/V Output: -45 to 121°C (-49 to 250°F)

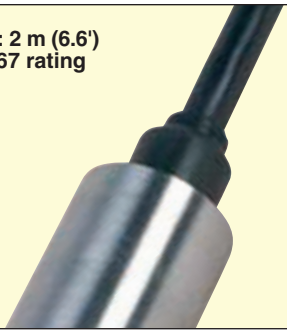
Amplified Output: -45 to 115°C (-49 to 239°F)

Compensated Temperature Range:

25 to 350 mB: -18 to 85°C (0 to 185°F)

1 to 350 bar: -29 to 85°C (-20 to 185°F)

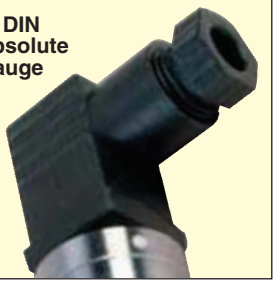
PXM409: 2 m (6.6') cable IP67 rating



PXM459: M12 connector IP67 rating, absolute IP65 rating, gauge



PXM419: mini DIN IP67 rating, absolute IP65 rating, gauge



B

Thermal Accuracy: % span shift over compensated temperature range

25 to 350 mB:

Zero: ±1.0% max

Span: ±1.0% max

1 to 350 bar:

Zero: ±0.50% max

Span: ±0.50% max

ROHS Compliant

Minimum Isolation Between Case and Terminations: 100 MΩ @ 50 Vdc

Pressure Cycles: 1 million, minimum

Long Term Stability (1-Year): ±0.1% FS typical

Shock: 50 g, 11 mS half sine shock, vertical and horizontal

Vibration: 5-2000-5 Hz 30 minute cycle, Curve L, Mil Spec 810 figure 514-2-2, vertical and horizontal

Bandwidth: DC to 1 kHz typical

Response Time: <1 ms

CE Compliant: Industrial Level

Emissions: IEC550022 Class B

Electrostatic Discharge Immunity: IEC1000-4-2

EM Field Immunity: IEC61000-4-3

EFT Immunity: IEC61000-4-4

Surge Immunity: IEC61000-4-5

Conducted RF: IEC610000-4-6

Rate Power Frequency Magnetic Field: IEC61000-4-8

Environmental Protection:

PXM409: IP67

PXM419: IP65 gauge, IP67 Abs

PXM459: IP65 gauge, IP67 Abs

Proof Pressure Gauge/ Vac/Compound:

25 mB: 10 times span
70 mB: 6 times span
170 mB to 100 bar: 4 times span
175 to 350 bar: to 500 bar max

Proof Pressure Absolute:

350 mB to 100 bar: 4 times span
175 to 350 bar: to 500 bar max

Secondary Containment; Gauge/Vac/Compound:

25 to 350 mB: to 70 bar
1 to 70 bar: to 200 bar
100 to 350 bar: to 700 bar

Absolute/Barometric:

350 mB: to 70 bar
1 to 70 bar (Includes Barometric Ranges): to 200 bar
100 to 350 bar: to 700 bar

Wetted Parts: 316L SS

Electrical Terminations

PXM409: 2 m (6.6') cable
PXM419: mini DIN with mating connector
PXM459: M12 4-pin

Pressure Port: G¼ standard

Weight: 115 to 200 gm depending upon configuration

Electrical Outputs

mV/V Output:

Output: 10 mV/V ratiometric

Supply Voltage: 5 to 10 Vdc (5 mA @ 10 Vdc)

Zero Balance:

Ranges > 170 mB: ±0.5% typ (1% max)

Ranges ≤ 170 mB: ±1% typ (2% max)

Span Setting:

Ranges > 170 mB: ±0.5% typ (1% max)

Ranges ≤ 170 mB: ±1% typ (2% max)

Input/Outut Resistance: 5000 Ω ±20%

Voltage Output:

Output: 0 to 10 Vdc
Supply Voltage: 15 to 30 Vdc @ 10 mA (±10 Vdc or compound)

Zero Balance:

Ranges > 170 mB: ±0.5% typ (1% max)

Ranges ≤ 170 mB: ±1% typ (2% max)

Span Setting:

Ranges > 170 mB: ±0.5% typ (1% max)

Ranges ≤ 170 mB: ±1% typ (2% max)

Current Output:

Output: 4 to 20 mA (zero pressure = 12 mA on compound ranges)

Supply Voltage: 9 to 30 Vdc (9 to 20 Vdc above 105°C) max loop resistance = (Vs-9) x 50 O

Zero Balance:

Ranges > 170 mB: ±0.5% typ (1% max)

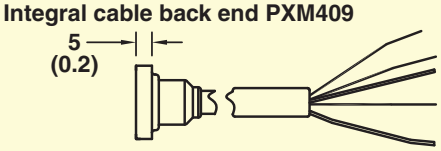
Ranges ≤ 170 mB: ±1% typ (2% max)

Span Setting:

Ranges > 170 mB: ±0.5% typ (1% max)

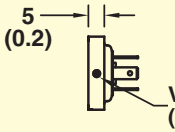
Ranges ≤ 170 mB: ±1% typ (2% max)

Integral cable back end PXM409

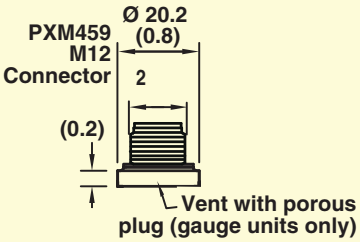


Dimensions: mm (inch)
Ø = diameter

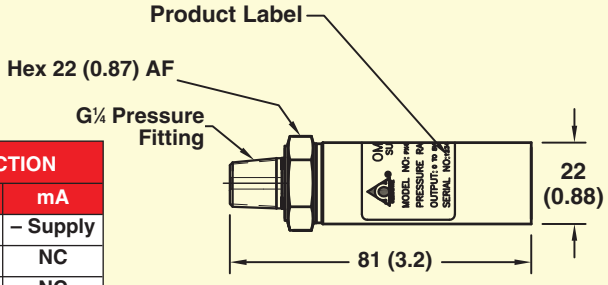
mini DIN back end PXM419



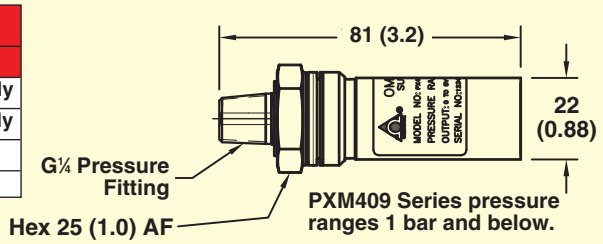
PXM409 CABLE CONNECTION			
Color	mV	5/10V	mA
Black	– EXC	Common	– Supply
White	+ SIG	+ Output	NC
Green	– SIG	NC	NC
Red	+ EXC	+ EXC	+ Supply



PXM419/PXM459 PINOUT			
PIN	mV	5/10V	mA
1	+ EXC	+ EXC	+ Supply
2	– EXC	Common	– Supply
3	+ SIG	+ Output	NC
4	– SIG	NC	NC

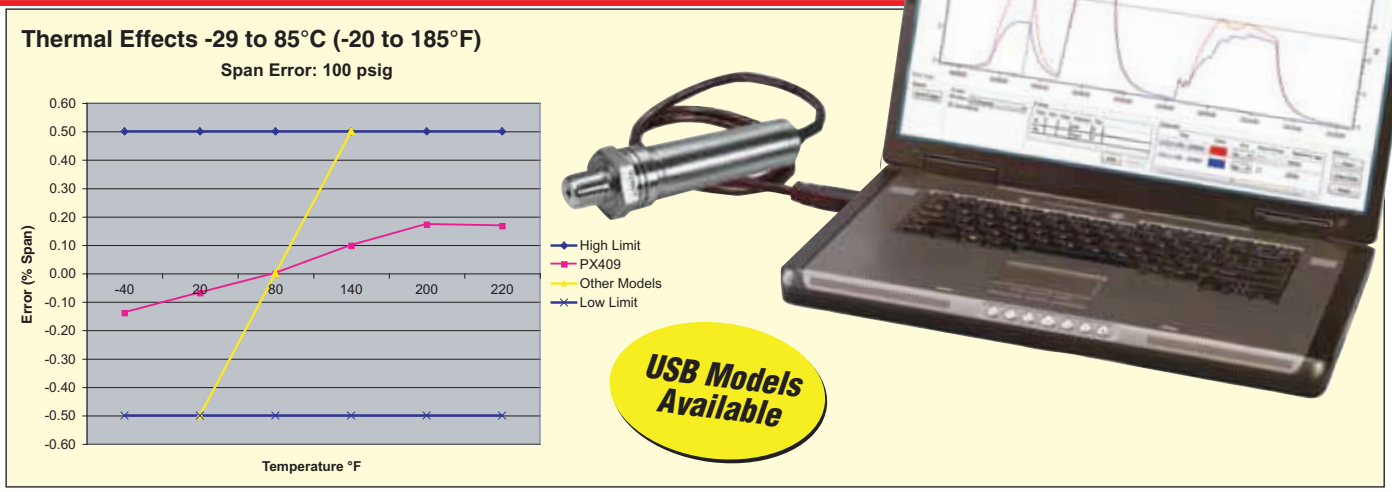


PXM409 Series pressure ranges >1 bar to 70 bar for pressure ranges above 70 bar consult factory.



PXM409 Series pressure ranges 1 bar and below.

Gauge and Absolute Pressure Models



B

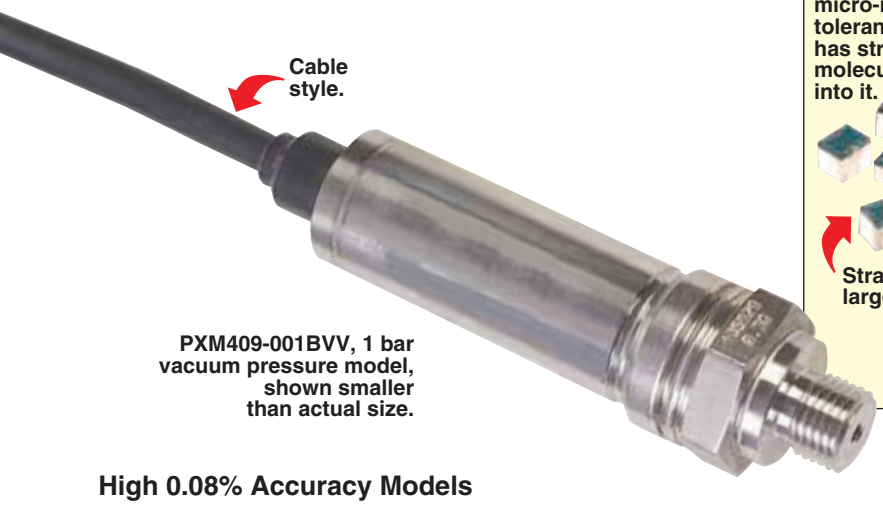
High 0.08% Accuracy Models

To Order

RANGE	MODEL NO. 0.08% ACCURACY	DESCRIPTION
GAUGE (RELATIVE) PRESSURE		
25 mbar (hPa)	**PXM4[*]9-025HG[**]**	25 mbar gauge pressure
70 mbar (hPa)	**PXM4[*]9-070HG[**]**	70 mbar gauge pressure
170 mbar (hPa)	**PXM4[*]9-170HG[**]**	170 mbar gauge pressure
350 mbar (hPa)	**PXM4[*]9-350HG[**]**	350 mbar gauge pressure
1 bar	**PXM4[*]9-001BG[**]**	1 bar gauge pressure
2 bar	**PXM4[*]9-002BG[**]**	2 bar gauge pressure
3.5 bar	**PXM4[*]9-3.5BG[**]**	3.5 bar gauge pressure
7 bar	**PXM4[*]9-007BG[**]**	7 bar gauge pressure
10 bar	**PXM4[*]9-010BG[**]**	10 bar gauge pressure
17.5 bar	**PXM4[*]9-17.5BG[**]**	17.5 bar gauge pressure
35 bar	**PXM4[*]9-035BG[**]**	35 bar gauge pressure
50 bar	**PXM4[*]9-050BG[**]**	50 bar gauge pressure
70 bar	**PXM4[*]9-070BG[**]**	70 bar gauge pressure
100 bar	**PXM4[*]9-100BG[**]**	100 bar gauge pressure
175 bar	**PXM4[*]9-175BG[**]**	175 bar gauge pressure
245 bar	**PXM4[*]9-245BG[**]**	245 bar gauge pressure
350 bar	**PXM4[*]9-350BG[**]**	350 bar gauge pressure
ABSOLUTE PRESSURE		
350 mbar (hPa)	**PXM4[*]9-350HA[**]**	350 mbar absolute pressure
1 bar	**PXM4[*]9-001BA[**]**	1 bar absolute pressure
2 bar	**PXM4[*]9-002BA[**]**	2 bar absolute pressure
3.5 bar	**PXM4[*]9-3.5BA[**]**	3.5 bar absolute pressure
7 bar	**PXM4[*]9-007BA[**]**	7 bar absolute pressure
10 bar	**PXM4[*]9-010BA[**]**	10 bar absolute pressure
17.5 bar	**PXM4[*]9-17.5BA[**]**	17.5 bar absolute pressure
35 bar	**PXM4[*]9-035BA[**]**	35 bar absolute pressure
50 bar	**PXM4[*]9-050BA[**]**	50 bar absolute pressure
70 bar	**PXM4[*]9-070BA[**]**	70 bar absolute pressure
100 bar	**PXM4[*]9-100BA[**]**	100 bar absolute pressure
175 bar	**PXM4[*]9-175BA[**]**	175 bar absolute pressure
245 bar	**PXM4[*]9-245BA[**]**	245 bar absolute pressure
350 bar	**PXM4[*]9-350BA[**]**	350 bar absolute pressure

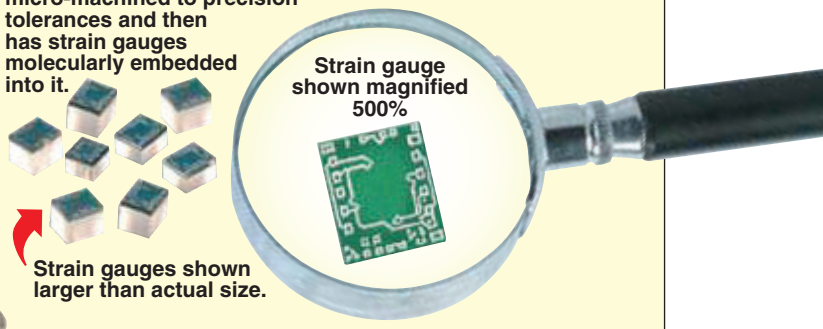
[*] [**] See next page for selection.

Vacuum, Compound and Barometric Pressure Models



PXM409 SERIES SILICON WAFER TECHNOLOGY

PXM409 Series uses a highly stable silicon wafer which is micro-machined to precision tolerances and then has strain gauges molecularly embedded into it.



High 0.08% Accuracy Models

To Order		
RANGE	**MODEL NO. 0.08% ACCURACY**	**DESCRIPTION**
VACUUM (NEGATIVE GAUGE) RANGES (ZERO OUTPUT = AMBIENT)		
25 mbar (hPa)	**PXM4[*]9-025HV[**]**	25 mbar vacuum (negative gauge)
70 mbar (hPa)	**PXM4[*]9-070HV[**]**	70 mbar vacuum (negative gauge)
170 mbar (hPa)	**PXM4[*]9-170HV[**]**	170 mbar vacuum (negative gauge)
350 mbar (hPa)	**PXM4[*]9-350HV[**]**	350 mbar vacuum (negative gauge)
1 bar	**PXM4[*]9-001BV[**]**	1 bar vacuum (negative gauge)
COMPOUND GAUGE RANGES† (BI-DIRECTIONAL OUTPUT)		
±25 mbar (hPa)	**PXM4[*]9-025HCG[**]**	±25 mbar compound gauge
±70 mbar (hPa)	**PXM4[*]9-070HCG[**]**	±70 mbar compound gauge
±170 mbar (hPa)	**PXM4[*]9-170HCG[**]**	±170 mbar compound gauge
±350 mbar (hPa)	**PXM4[*]9-350HCG[**]**	±350 mbar compound gauge
±1 bar	**PXM4[*]9-001BCG[**]**	±1 bar compound gauge
BAROMETRIC (ABSOLUTE) PRESSURE RANGES		
0 to 1100 hPa	**PXM4[*]9-1100HB[**]**	0 to 1100 mbar barometric
550 to 1100 hPa	**PXM4[*]9-550HB[**]**	550 to 1100 mbar barometric
880 to 1100 hPa	**PXM4[*]9-880HB[**]**	880 to 1100 mbar barometric

ACCESSORIES

MODEL NO.	DESCRIPTION
CX5302	Replacement micro mini DIN connector for PXM419, 4 contacts on 9.4 mm (0.37") spacing with PG7 gland
CX5303	Micro mini DIN connector, 4 contacts on 9.4 mm (0.37") spacing with ½" conduit fitting
M12C-PVC-4-S-F-5	PVC cable, straight 4-pin M12 female connector one end, flying leads one end, 5 m (16') long
M12C-PVC-4-S-F-10	PVC cable, straight 4-pin M12 female connector one end, flying leads one end, 10 m (32') long
COMPATIBLE PANEL METERS	
DP25B-S	4-digit strain meter for mV/V transducers
DP25B-E	4-digit process meter for 10V or 4 to 20 mA transducers
DP41-B	6-digit process meter for 10V or 4 to 20 mA transducers

[*] Select Electrical Termination: ***0*** *= 2 m (6') cable,* ***1*** *= mini DIN,* ***5*** *= M12, 4-pin male connector.*
[**] Select Output: ***V*** *= 10 mV/V,* ***10V*** *= 0 to 10 Vdc,* ***I*** *= 4 to 20 mA.*
† Compound range models are calibrated in the positive direction only.
Ordering Examples: PXM409-007BGV, *0.08% accuracy, 7 bar range, 10 mV/V output, cable termination.*
PXM419-001BAI, *0.08% accuracy, 1 bar absolute range, 4 to 20 mA output, mini DIN termination.*
PXM459-350HV10V, *0.08% accuracy, 350 mbar Vacuum (ambient to -350 mB) range, 0 to 10 Vdc output, M12 termination.*