Senstronics-**Servocontrols**

Superior thin film sensing products

Storm

- the future of pressure and temperature measurement

www.sevocontrolsindia.com

Senstronics-Servocontrols

Company Introduction

At Senstronics we believe that to build the world's finest range of sensing products we must employ the latest art, with an uncompromising attitude. Senstronics is proud to present the Storm programme, a unique range of products that has been constructed to provide you, our customer with "a life time of accuracy".

Located in the United Kingdom, Senstronics takes an immense pride in its ability to support the individual needs of our international customer base. The range of engineering skills contained within the Group's Technology Centre will ensure that as we come to know more of each other, Senstronics will become your sensing partner of choice.

Install Storm and have quiet nights.

S.B. Turner

Group C.E.O.


CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of

Senstronics Ltd
Ayecliffe Industrial Estate, Co Durham
United Kingdom

has been approved by Lloyd's Register Quality Assurance to the following Quality Management System Standards:

BS EN ISO 9001:2000
EN ISO 9001:2000
ISO 9001:2000

The Quality Management System is applicable to:

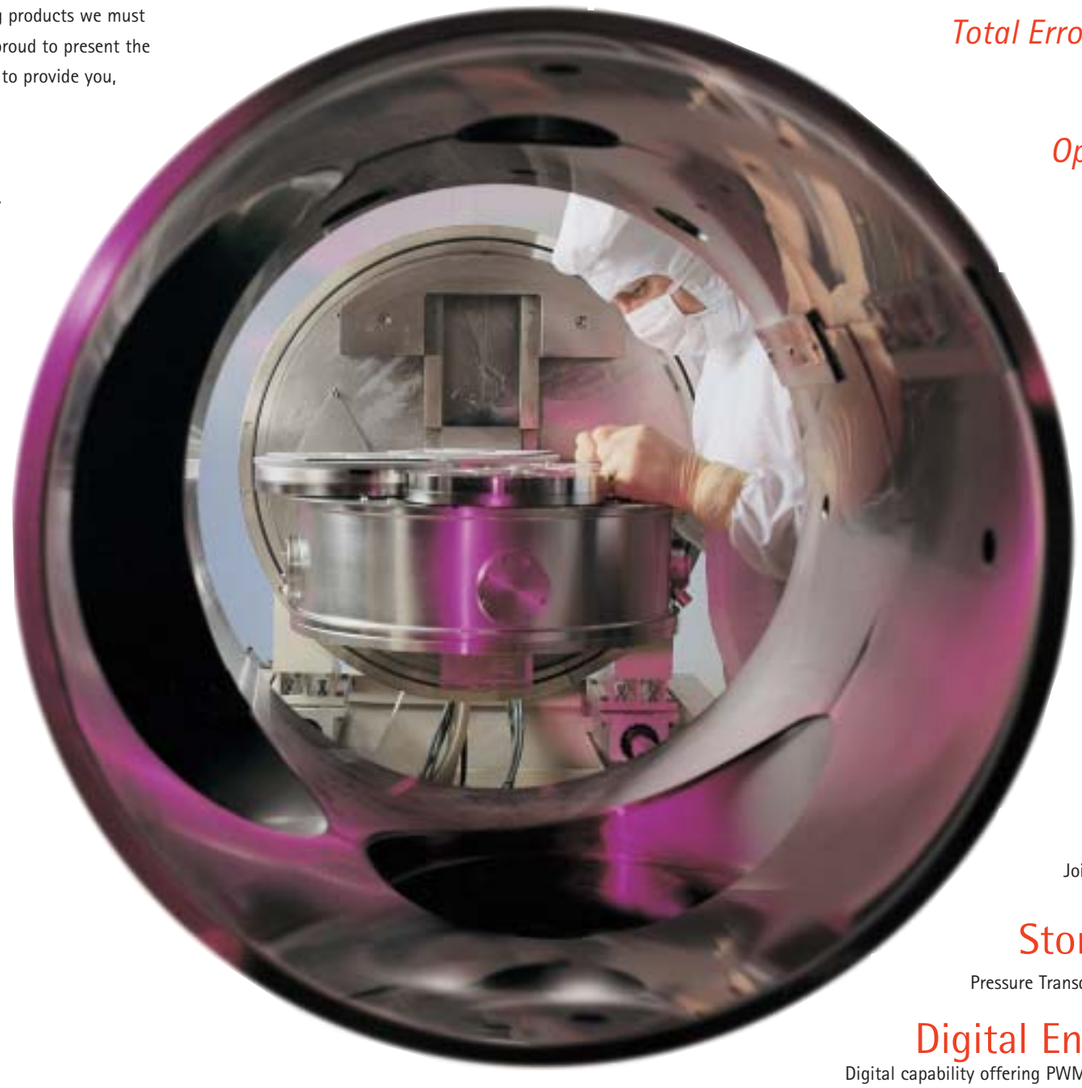
Design, development and manufacture of pressure sensor elements and transducers.

Original Approval: 10 December 2001
Current Certificate: 10 December 2001
Certificate Expiry: 15 December 2004

Issued by: LRQA Germany

LLOYD'S REGISTER QUALITY ASSURANCE

ISO Accreditation gained 2001



The Headlines

Total Error Band Pressure ±1% (per 100˚C)
Temperature ±1% (per 100˚C)

Operating Temperature -40 to 125˚C

Long term stability 0.1%
(10m cycles)

EMC Rating >100volts/metre

The Storm Family

Storm 10
Pressure Transmitter

Storm 30
Pressure Transducers

Storm 50
Joint Pressure and Temperature Transducers

Storm 70 (available Q1, 2004)
Pressure Transducers with integral pressure switch

Digital Engineering
Digital capability offering PWM and CAN

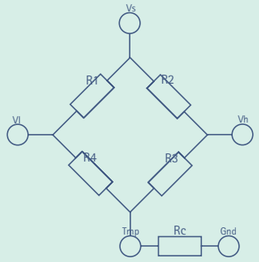
Sensing Technology

Principles

Pressure can be measured in a variety of ways although fundamentally based on two key principles:

1. Wheatstone bridge

Bridge resistors are placed on a flexible diaphragm in such a way that they are stretched or compressed under pressure. The physical changes cause a change in resistance and a differential output signal that is directly proportional to the applied pressure.

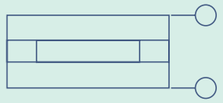


Wheatstone bridges can be made from metal resistors or piezo resistive materials. The latter offers greater signal outputs from the unconditioned bridge due to crystal lattice dopant effects as well as the mechanical distortion.

Bridges can be bonded onto diaphragms via a number of techniques including glues, silicon/ceramic fusion, or direct molecular bonding (PECVD or sputtering). Occasionally piezo-resistive elements are incorporated into oil filled isolation cells protecting the strain gauge from corrosive chemical media.

2. Capacitive

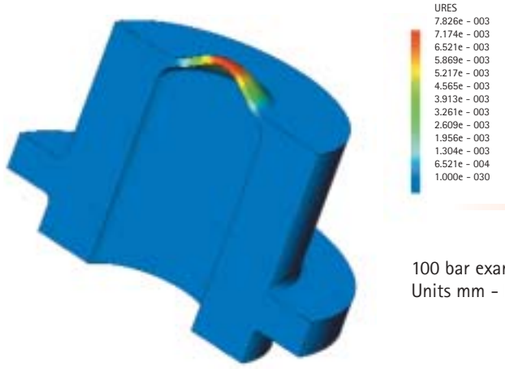
The capacitance of two conducting planes is measured. Under pressure the plates are forced together reducing the capacitance in line with applied pressure.



Capacitive pressure sensors can be constructed in ceramics, via advanced MEMS technology (dies), or built into semi-conductor layered materials. Depending on the technology used the sensor elements are either packaged and used as produced, bonded (fused) onto metal/glass substances or incorporated into oil filled cells.

References

Transducers and Interfacing - principles and techniques; B.R. Bannister & D.G. Whitehead (Van Nostrand Reinhold (UK)
Fundamentals of Pressure Sensing; Jon Wilson, Principal Consultant, The Dynamic Consultant, LLC (www.sensorsmag.com)
For further reading on this and related topics, see these Sensors articles.
"Bringing MEMS Pressure Sensors to Market—Fast," January 2001
"Using the IEEE-1451.2 Correction Engine to Compensate a Multivariable Smart Pressure Transmitter," August 1999
"Fundamentals of Pressure Sensor Technology," November 1998



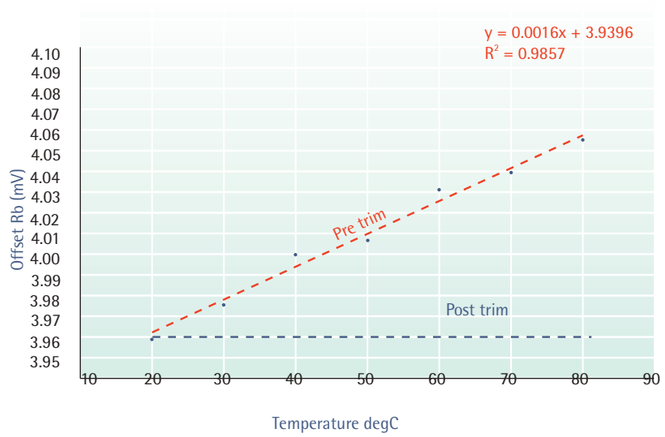
100 bar example - Static displacement
Units mm - Deformation scale 1:100

Why thin film electronic strain gauge?

- Long term stability
- Ease of temperature compensation
- No oil fill
- Wide operating range of pressure and temperature from one single element profile
- High volume processing is feasible
- Signal linearity

All piezo resistive and silicon based technologies are prone to long term drift caused by dopant migration and fermi-level effects. These effects are exaggerated at elevated temperatures, and also by extended pressure cycling.

Oil fill isolation causes unwanted thermal instability due to differing co-efficients of thermal expansion of oil and steel enclosures. Non-linearity over temperature is a significant problem where accuracy is required. There is also the potential of leak-paths from or past the oil filled cell, which may be undesirable. The operational temperature range is limited at both high and low extremes.



Electronic strain gauges produce very linear and predictable signals over temperature. Understanding this behaviour allows Senstronics to manufacture inherently stable sensor elements in high volume with dual pressure and temperature outputs.

Senstronics Technology

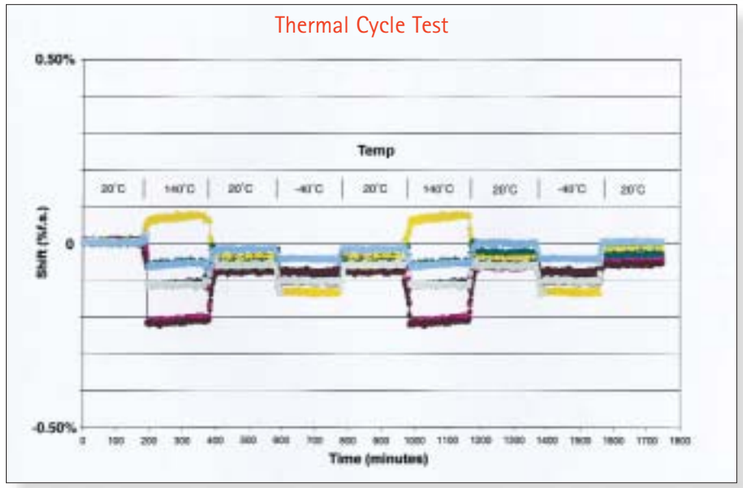
A new team for a new challenge.

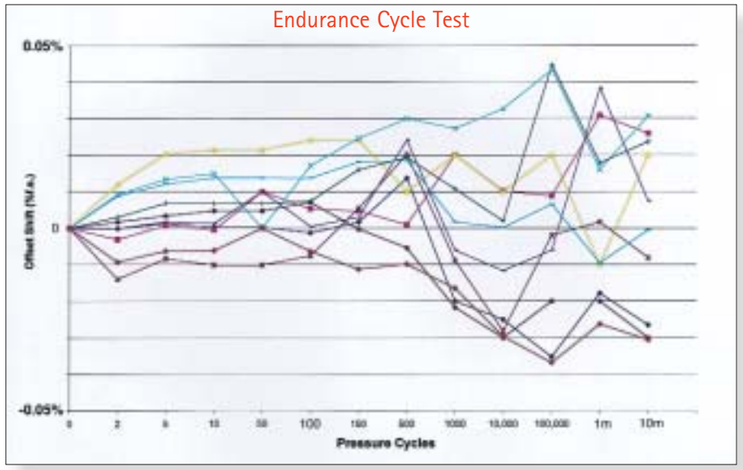
The Senstronics thin film technology and its manufacturing process have no equals, a just reward for six years dedication and the search for uncompromised perfection.

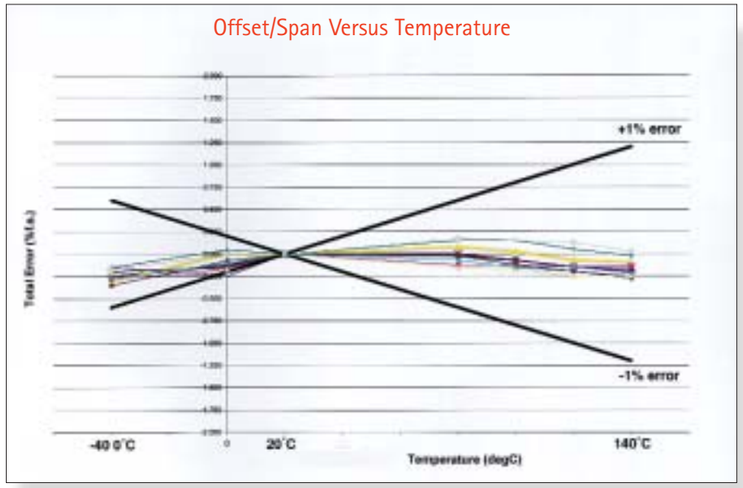
The Team's commitment to philosophy that believed that the benefits of long term stability and measurement accuracy should be available to all customers at no extra cost, has resulted in a manufacturing process called TCAS which simply means "Thermal Compensation At Source".

TCAS working together with the Senstronics element technology called Thermotec™ ensures that sensing elements leave the Fab for final assembly, manufactured to a staggering thermal accuracy of less than 0.005% / degree C.

Source: Senstronics Quality Audit Testing







Thin Film is renowned for its mechanical stability and repeatability

Engineering

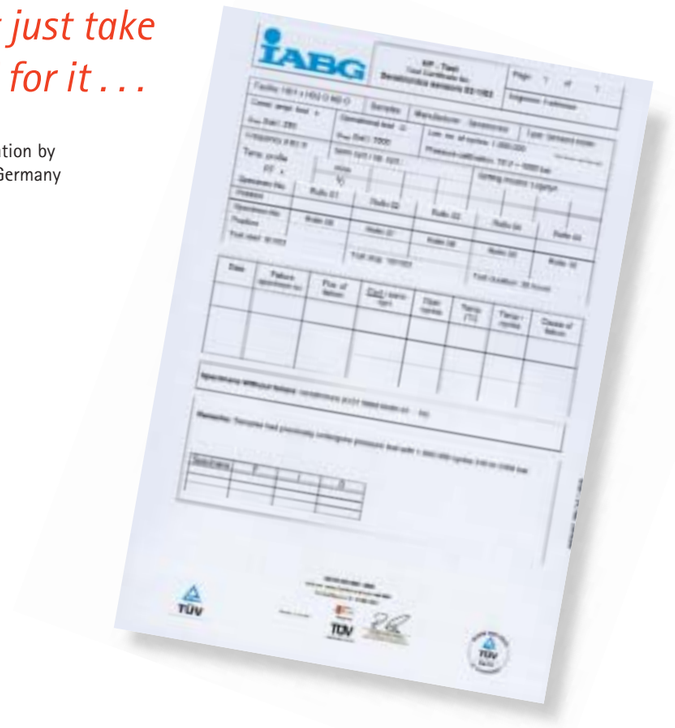
Welding

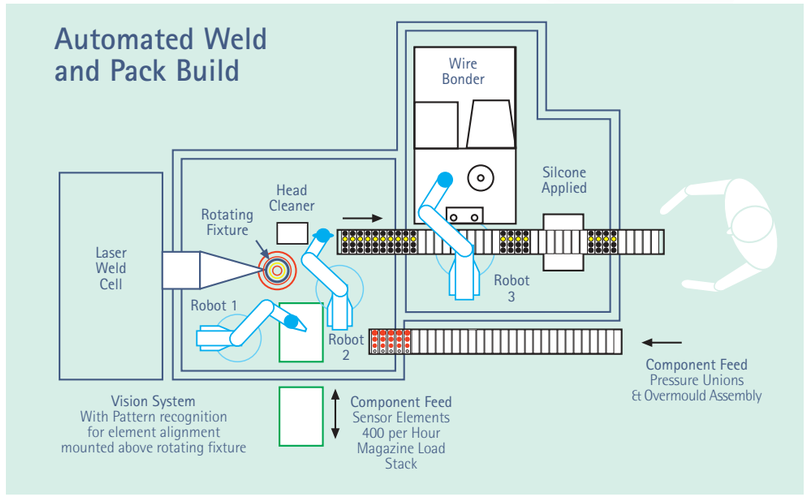
Design Engineers from around the world would agree that to craft the finest products there can be no substitute for using the finest raw materials. The Storm programme uses 17.4PH Stainless Steel known for its excellent mechanical and media compatibility properties for both the sensing element and the union. By using similar metals, Senstronics has guaranteed a weld integrity that can withstand millions of continuous pressure cycles up to 2200 bar (33,000 psi).

Advanced weld systems are used for our entire range of pressure transducers from 7 bar (100 psi) to 2,200 bar (33,000 psi).

but don't just take our word for it . . .

Independent verification by
I.A.B.G. Stuttgart - Germany





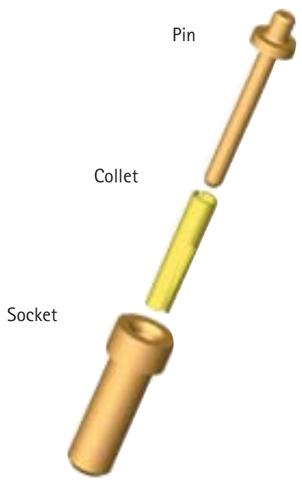
PCB Interconnection

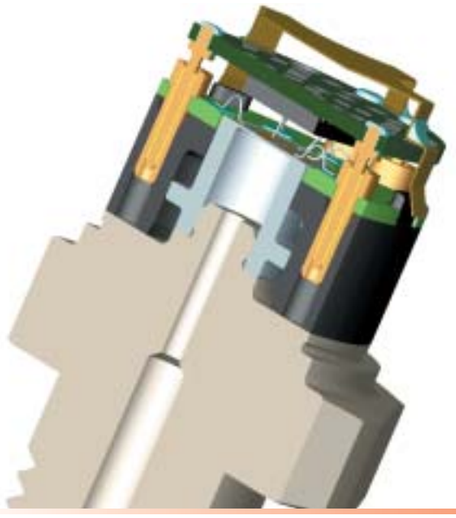
Internal build quality

The reliability of electronic assemblies is dependent on the integrity of electronic connections. Here again, the Storm programme shows its total commitment to excellence.

The sensing element is wire bonded to the interface PCB by aluminium wire with bond strengths of not less than 150 grams.

The ASIC PCB connects to the interface PCB using gold plated pins and precision collet assemblies.





but don't just take our word for it . . .

Temperature and vibration testing.

The ASIC PCBs are soldered directly to the connector pins to minimise joints.

>100g vibration

Electronics

ASIC Specifications

ASIC Family		
Name	SEN-1000	
Application Requirement	Industrial	Automotive
Output 1 (pressure)	volts absolute, current, ratiometric (typ: 0-5, 1-6, 0-10V, 4-20mA, 0.5-4.5V)	ratiometric (typ: 0.25-4.75V, 0.5-4.5V)
Output 2 (temperature/pressure switch)	volts absolute, ratiometric (typ: 0-5, 1-6, 0-10V, 0.5-4.5V)	N/A
Output Type	analogue - infinite	analogue - infinite
Clock Freq.	Internal RC oscillator 2MHz	Internal RC oscillator 2MHz
Operating Input Voltage Range	8-30V (voltage regulates when required)	5V +/-10%
Over-voltage Protection	30V	16V
Reverse-voltage Protection	-30V	-16V
Memory (comms through output 1 pin)	OTP	OTP
Output 1 Signal Linearisation	3-point	3-point

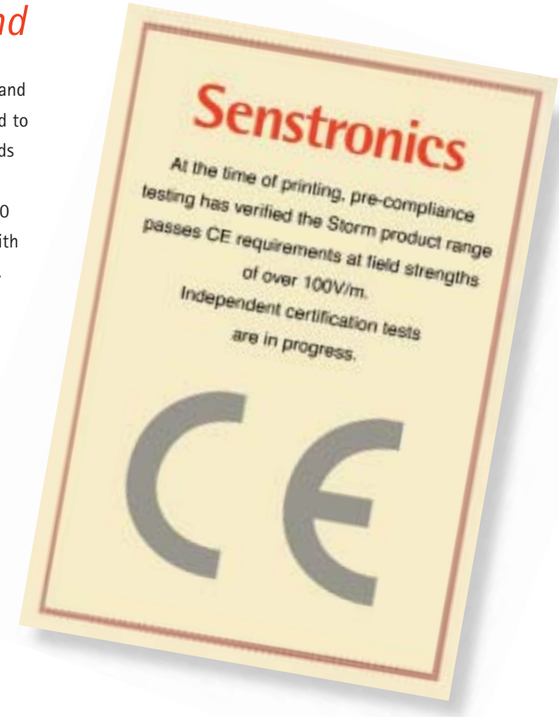
* other calibrations available / digital output data format tbd

In creating the Storm programme, Senstronics has made a significant investment into the design and development of its own range of high performance signal conditioning ASICs. This growing family of ASICs has been specifically engineered to maximise the potential of thin film sensing technology and to meet the foreseeable needs of our future customers. These include joint pressure and temperature, digital and canbus options.

In house design control ensures a readiness to apply our ASIC design skills to those customer applications requiring something special.

C. E. and beyond

The Storm range of Transducers and Transmitters has been engineered to satisfy the most rigorous demands for EMC. As standard all Storm Products are rated to at least 100 Volts per metre in accordance with EN61000-6-2 and EN61000-6-3.



>100V/m

Unique Features

Storm 10/30

Pressure transmitters and transducers

Our standard pressure products offer industry leading total error bands of 1% inclusive of temperature effects over 100˚C temperature span.

Storm 50

Joint pressure and temperature transducers

The TCAS and Thermotec™ technology which endows Senstronics sensor elements with their unique temperature stability is based on the use of a compensation resistor placed in series with the Wheatstone Bridge. This presents us with the opportunity to produce dual pressure and temperature outputs, which can be fully conditioned by our specially designed SEN-1000 ASIC

Storm 70 (available Q1,04)

Pressure transducer with integral switch function

There are applications in hydraulic control systems requiring a continuous pressure output in addition to an electric switch function. This can be accommodated easily by the use of a comparator on the pcb within the transducer itself.

Canbus and digital outputs

Many of our customers are already looking at future applications where digital outputs are desirable. Our software design engineers are fully conversant with CAN 2OB and similar control protocols. PWM and other digital formats can also be accommodated within the transducers using the digital version of our ASIC.

Special design capabilities

Senstronics is uniquely supported by our Technical Centre with a dedicated team of software, electronic and mechanical design engineers. Our capabilities extend beyond pressure transducer design and manufacture to complete control systems and transducer integration. We consider ourselves to be the most vertically integrated pressure transducer manufacturer in the world, able to address customer specific design projects.

Transducer Specifications

ELECTRICAL					
Parameter	**Min**	**Typ**	**Max**	**Units**	**Comment**
Supply Voltage (Vdd)	8	14	30	V	Absolute voltage & current applications
Supply Voltage (Vdd)	4.5	5	5.5	V	Ratiometric applications
Offset Calibration Point (20˚C)	-0.25	0	+0.25	%f.s.	
Full-Scale Calibration Point (20˚C)	-0.25	0	+0.25	%f.s.	
Power-on Response Time			10	ms	
Over-Voltage Protection			30	V	
Reverse Voltage Protection			-30	V	
Current Draw*			<8	mA	Voltage mode
Short Circuit Current					Protected indefinitely
Resolution					Infinite – analogue path, 12 bit digital

THERMAL				
Parameter	**Min**	**Typ**	**Max**	**Units**
Thermal Operating Range	-40		+125	˚C
Total Thermal Accuracy	-0.5	0	+0.5	%f.s. per 100˚C
Thermal Hysteresis			<0.05	%f.s.

MECHANICAL			
Parameter	**Typ**	**Max**	**Units**
Linearity		<0.1	%f.s.
Hysteresis		<0.05	%f.s.
Mechanical Stability (After 10m f.s. pressure cycles)	0.1%		%f.s
Static Over-Pressure+	x2		rated pressure range
Dynamic Over-Pressure+	x1.25		rated pressure range
Burst Pressure	x6		rated pressure range
Frequency Response (Resonance)			>10kHz
Pressure Response Time* (For 10-90% ideal step function)			<1 ms
Internal 'dead' volume	0.2		cc

* with external 5k pull-down in voltage applications.

\+ with offset shift <±0.1%f.s.

The benefits of Senstronics' technology, uncompromising design and build standards and state of the art production processes are manifested in our transducer performance specifications.

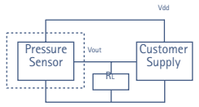
We pride ourselves in providing our customers with products which will exceed their expectations for stability and performance, year in, year out.

Whilst many of our competitors provide specifications with some errors omitted (typically temperature and drift effects), our aim is to provide clarity in an unashamed manner.

Total error band inclusive of ALL errors is typically less than 1% for both pressure and temperature outputs.

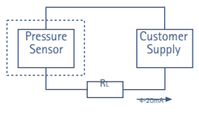
Specifications

Installation Circuits



VOLTAGE APPLICATION - TRANSDUCERS					
Parameter	**Min**	**Typ**	**Max**	**Units**	**Comment**
Supply Voltage (Vdd)	8		30	V	Absolute mode. 'Head-Room' Vdd = Vout + 1.5V
Supply Voltage (Vdd)	4.5	5	5.5	V	Ratio-metric mode.
Output Absoluteness		0.2		%f.s.	Absolute mode reference Vdd=15V
Ratiometricity		0.5		%f.s.	Ratiometric mode reference Vdd=5V
Output Impedance^	68 -10%	68	68 +10%	Ohms	
Pull-Down Resistor (RL)	2.5k	5k	O/C	Ohms	

^ effect of external pull-down resistor removed at calibration.



CURRENT APPLICATION - TRANSMITTERS					
Parameter	**Min**	**Typ**	**Max**	**Units**	**Comment**
Supply Voltage (Vdd)	8		30	V	
Maximum Load Resistor (RL)	0		1000	Ohms	

Typical Installation Criteria

Response Time	<1 ms
Power-on Time	10 ms
Pull-up/Pull-down Resistor	During calibration we use a standard set up 15 kOhms pull down resistor. Where this is incompatible with customer application circuits we can accommodate a wide range of pull-up and pull-down resistors during calibration. Consult Sales for further details.
Current Draw	In voltage mode max 8 mA
	In current mode max 20 mA, min 3.5 mA
Reverse Polarity	-30 V
Humidity	MIL-STD-833E Method 1004.7
Vibration	MIL-STD-883E Method 2005.2 Condition A
Mechanical Shock	MIL-STD-883E Method 2002.3
Thermal Shock	MIL-STD-833E Method 1011.9
Plastic Material Types	PBT 30% GFR
Weight	Approx 50 g

Standard Options

Pressure Union

G1/4 integral seal
G1/4 bonded seal
1/4 NPT male
1/8 NPT male
7/16 UNF flare
M12 x 1.5 6g
M18 x 1.5

Pressure Range

BAR	PSI
7	100
10	150
16	200
20	300
35	500
70	1,000
100	1,500
160	2,000
250	3,600
400	5,000
700	10,000
1000	15,000
1600	20,000
1800	25,000
2000	30,000
2200	32,000

Electrical Connector

GDS 207
M12 (cable option)
AMP SuperSeal
DIN 72585
Packard Metripack
Deutsch 4 pin
Sicma II

Our product range continues to grow. Consult sales for latest options

Output Options

Typical Output	Joint Pressure & Temperature*
0-5V	✔
1-6V	✔
0-10V	✔
0.5-4.5V ratiometric	✔
0.25-4.75 ratiometric	✔
4-20mA	Pressure only
Digital - PWM	✔
Canbus - 2.0B	✔

* The temperature output can be calibrated to suit your particular needs. Typical ranges are -40 to +140°C, -20 to +125°C and 0-85°C.

Customer Specials

Specific Voltage Offsets

Special Digital Designs

Differential Pressure

SCP	400	6	2	4	1

Pressure Transducer

PRESSURE RANGE IN BAR

20
60
100
250
400
700
1000
1500
1800
2200

PRESSURE CONNECTION

G 1/4	1
1/4” NPTF	2
1/8” NPTF	3
M12 x 1.5WITH SPIGOT	4
7/16” UNF	5
1/4 ” BSP	6

INPUT VOLTAGE

5 VOLTS REGULATEDG 1/4	1
12-35 VOLTS	2
10 VOLTS IS THE MAX REC INPUT FOR UNCONDITIONED SENSORS	3

OUTPUT VOLTAGES

0.5-4.5 V RATIOMETRIC	1
0-5 VOLTS	3
0-10 VOLTS	4
4-20 mAmp	5
2 mV/V typical for unconditioned output	6

ELECTRICAL CONNECTION

DIN 43650 (ip65)(GDS)	1
Bayonet DIN 72585 (IP69K)	2
AMP Superseal (IP67)	3
M12 FLYING LEADS	4
AUTOMOTIVE CONNECTORS (CONSULT)	5

Senstronics-Servocontrols

Where to find us!

Contact Information

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