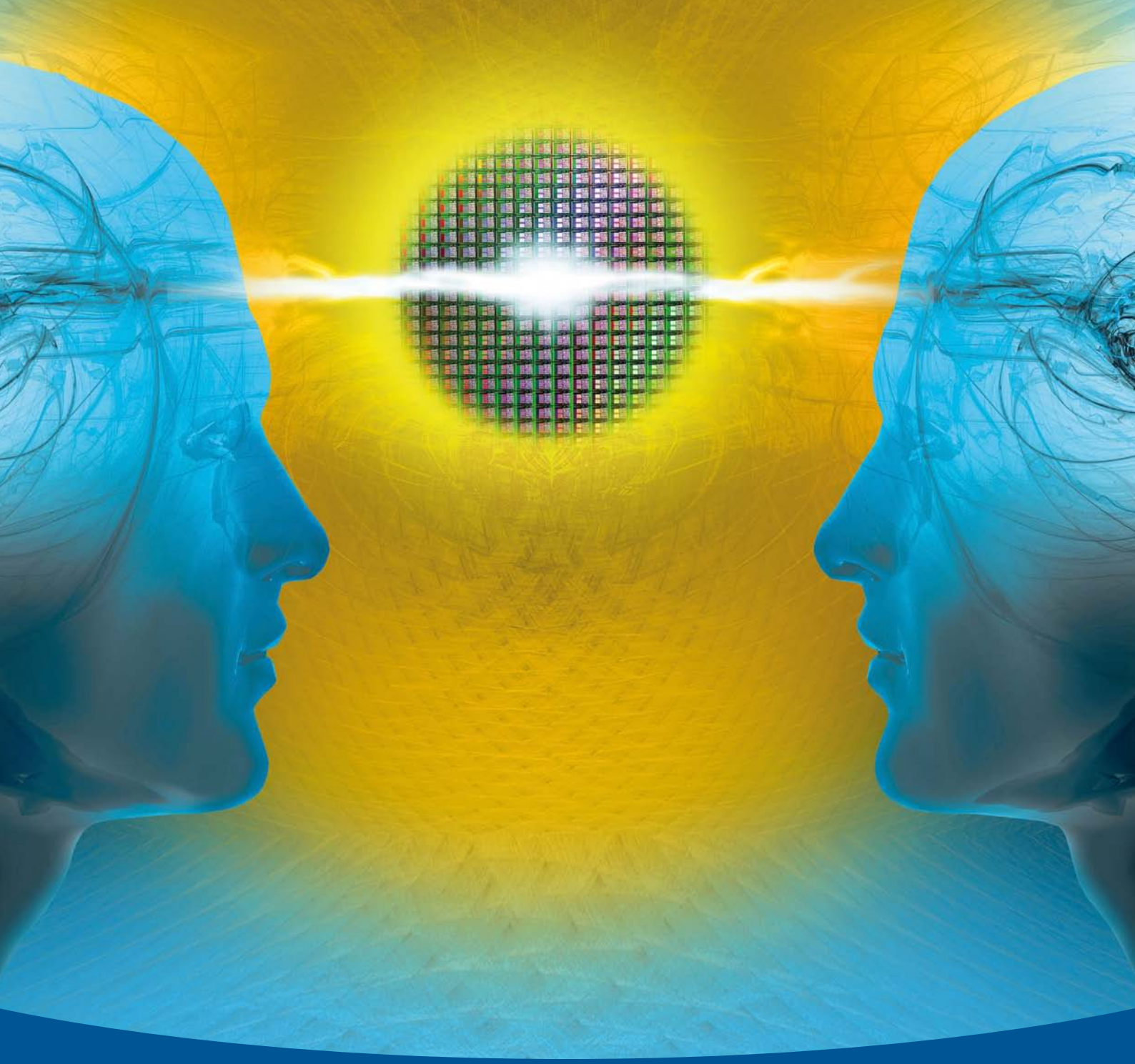
TITAN

Robust Industrial Pressure Sensor with 4…20 mA Output



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Semiconductors Developed with and for Our Customers!

We already provide our customers with highly specific support in markets where intensive consultation is required, such as general lighting, automotive, consumer, renewable energies, FPGAs, medical technology and RF & wireless. Now we are going one step further and raising our services to the next level with a new and revolutionary service.

Under the name EBVchips, we are now defining our own semiconductor products, which we are developing with and for our customers!
These products will be manufactured by our suppliers, fulfilling special requirements of customers not covered by products already available. This makes EBV the first semiconductor specialist in the world to offer such a service. With EBVchips, we offer our customers competitive advantages, as they will now receive exactly the products and technologies they require for their individual applications.
For further information, please contact your EBV partner on site or visit us online at **www.ebv.com/ebvchips**.

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TITAN: AUTOMOTIVE KNOW-HOW FOR INDUSTRIAL SENSORS

Take a pressure sensor, manufactured in millions of pieces each year for automotive applications, add a special 4/20 mA interface for industrial applications and you have a new pressure sensor that despite its high quality and superb technical data is most cost effective.

This „cooking recipe“ compresses and simplifies in a few lines EBV Elektronik's procedure in defining and developing its latest product Titan within „EBVchips“. Once many industrial customers have inquired again and again the distributor's over 120 FAE's for cost efficient but very precise and high quality pressure sensors the company's internal search for a solution started.

With the dutch/american company Sensata Technologies EBV Elektronik finally found the suited partner to accomplish the Titan project. Sensata produces 75 million pressure sensors in this capacitive ceramic technology per year for the automotive industry. Although these sensors fulfill the stringent automotive quality criteria they all have a ratiometric 0/5 V output. However a 4/20 mA output is the industry's usual standard the sensors without the current interface were only suited for very dedicated industrial applications.

CERAMIC AS A BASE

Since 1985 Sensata manufactures pressure sensors based on its ceramic technology. In an automobile these sensors are used in many different places with a pressure sensor for the air conditioning's compressor loop in a car being the first application. Meanwhile Sensata holds a market share of over 80% in this application. Enhanced versions of this ceramic-based pressure sensor meanwhile are present in automatic gear boxes, fuel applications for low pressure systems (Diesel) or for measuring oil pressure. Based on this technology Sensata manufactures pressure sensors that work from underpressure up to 80 bar.

The sensor's basis element comprises of ceramic substrate with about 3 mm thickness and a thin, flexible ceramic membrane with thickness of about 0.6 to 1.2 mm. The ceramic membrane is attached to the ceramic substrate in a highly defined distance using a glass

bonding process. Regarding their assembly sensors with different pressure ranges distinguish themselves only through membranes with different thickness as well as electronic calibration. On both ceramic parts there is a thin gold layer that is connected to the electronics via contact leads. Both gold layers form a capacitor with its capacity changing as a function of pressure put onto the membrane. The capacitor's capacity is in the 15 pF range.

Using a proprietary charging / discharging process Sensata evaluates the change of capacity relatively to a reference capacitor to generate an output voltage between 0 and 5V. This process has proven in many generations with Sensata systematically improving the electronics, the calibration and the temperature stability over the recent decades while the basis process always stayed untouched. Each single sensor is calibrated at room temperature. As part of the production process the sensors are validated at 23 °C and 135 °C. Also in the upper and lower pressure range a calibration is conducted. All these measures are purely analog without using digital electronics. In manufacturing as well as in the field this process has proven to be extremely stable. Within a core range the sensor elements show rather linear characteristics. Only at the lower and upper end of the scale there are larger non-linearities.

FROM CARS TO CONSUMER AND INDUSTRIAL

Since end of 2011 new cars sold in the EU must be equipped with an ESP system for driving stability. Core elements of each ESP are two sensors – an angular rate sensor and an acceleration sensor. In the mid-1990s the first ESP systems were put on the market, but only in premium cars. The reason was that at the time the sensors were difficult to produce and very expensive. Shortly after the legendary moose-test in 1997 all of a sudden ESP systems were available down to the compact class. ESP's commercial success started with using high quality and relatively cheap to produce silicon-based angular rate sensors and acceleration sensors. Today inexpensive angular rate sensors and acceleration sensors (MEMS-based) can virtually be found in each new Smartphone and in most of the game consoles with prices for those sensor types falling dramatically due to mass production for cars. At the same time there were no significant quality problems with those consumer sensors because the automotive suppliers had already assured a very high base quality in manufacturing.

Similarly, as part of its EBVchips initiative, EBV has taken an automotive pressure sensor, adapted it to the industry's requirements and equipped it with the suited 4/20 mA interface. Because those pressure sensors enjoy mass deployment in vehicles since many years the pressure sensor vendor has the quality perfectly under control. Industrial customers have a reason to be pleased about significant double digit price advantages due to high-volume production.

EBVCHIP TITAN PROVIDES 4/20 MA OUTPUT

So that the sensors can be used in industrial applications they need a 4/20 mA output. On the initiative of EBV Elektronik the Titan pressure sensors equipped with an industrial output interface were co-created to satisfy our customer requirements.

Thereby EBV makes Sensata's pressure technology, originally developed for automotive applications, also available for industrial customers. As a result the sensors can also be used in process automation systems and other applications. In this case the complete 4/20 mA sensor solutions are those Titan products that are marketed by EBV as part of its EBVchips activities. EBV did deliberately not limit the term „EBVchips" only to silicon. Among EBVchips are ICs, integrated modules or in this case industrial sensors in a screw mounting housing.

MANY OPTIONS

Currently those EBVchips pressure sensors are available in brass versions for the four pressure ranges 0 – 10 bar, 0 -16 bar, 0 – 20 bar and 0 – 35 bar. Also available are variants in plated steel for the 0 – 46 bar range. If required and the appropriate volume is needed EBV Elektronik and Sensata are able to produce other variants equipped with different connectors, different mechanical connection or packaging. At present the pressure sensors are classified according IP65, IP67 and IP6K9 (all with cable).

Because the sensor is powered via the signal line, the Titan sensors only use two connection lines having the relevant length for usage in harsh industrial environments where EMC is an issue. The industrial pressure sensors are immune to electrical interferences of up to 30 V/m.

ABOUT EBV ELEKTRONIK

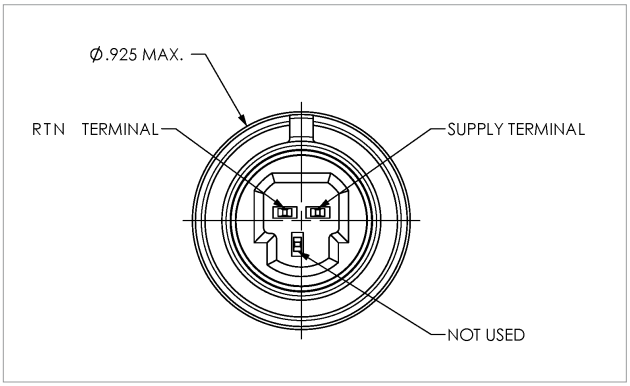
EBV Elektronik, an Avnet (NYSE:AVT) company, was founded in 1969 and is the leading specialist in European semiconductor distribution. EBV maintains its successful strategy of personal commitment to customers and excellent services. 260 Technical Sales Specialists provide a strong focus on a selected group of long-term manufacturing partners. 120 continuously trained Application Specialists offer extensive application know-how and design expertise. Warehouse operations, complete logistics solutions and value-added services such as programming, taping & reeling and laser marking are fulfilled by Avnet Logistics, EBV's logistical backbone and Europe's largest service centre. EBV operates from 60 offices in 27 countries throughout EMEA (Europe – Middle East – Africa). For more information about EBV Elektronik, please visit www.ebv.com.

Interested in more product highlights and market updates from EBV Elektronik? Subscribe for our newsletter at www.ebv.com/newsletter.

Across the whole temperature range of -20 °C - +100 °C the measurement error is less than 2%. At 25 °C the measurement error across the entire pressure range is only 0.75% – this applies for more than 10 million specified pressure measuring cycles. Therefore the sensors are among the most accurate parts on the market. The reverse polarity protected sensor's operating voltage can be 6 - 30 VDC. Also the sensors can handle voltages up to 39 VDC without damage.

Vibrations up to 10 g with a frequency of 25 Hz – 2,000 Hz do not harm the pressure sensors. The sensors also sustain shocks of 100 g coming from various directions with 6 Hz (half sinus). In all cases the UL and RoHS compliant CE certified sensors make their measurement result reliably available after a response time of <10ms via the cost-efficient but IP6K9 protection rated Delphi-Packard connector on the output. As sealing material for the internal O-ring Sensata uses neoprene, and fluorocabon. The bursting pressure corresponds to the five-fold measurement pressure.

Using a hexagonal screw terminal (1/8" male, ¼" female) the pressure sensors are not only suited for industrial process automation applications but also for applications like pumps and compressors as well as HVAC (heating, ventilation, and air conditioning) plus fridges and freezers. In the area of process automation for example there a important applications in the fields of hydraulic systems, pneumatics, lifts, liquids and gases. Some of the most important pump and compressor applications are industrial cleaning systems, (car) washing systems, water-based high-pressure cleaners, water and auxiliary pumps as well as pneumatic systems. The HVAC and fridges and freezers sector not only includes industrial freezing technology but also building automation, heat pumps as well as fridges and freezers for food and retail.



WIN-WIN SITUATION

„Via EBV Elektronik's extensive network we have access to an entirely new customer base in the field of industrial electronics," explains Ing. Roger Appelo, Business Development Manager for sensor products at Sensata in Europe. „On the other hand EBV Elektronik will have access to a high quality and completely mature sensor technology that still holds plenty of potential. In our view this clearly is a win-win situation. Mass producing the corresponding automotive sensors in quantities of several millions a year EBV is able to offer the pressure sensors with very attractive pricing." Those EBVchips were developed partly in the Netherlands and partly in the US. The complete sensor including ceramic production will be fabricated in Mexico, where Sensata also produces it's automotive sensors.

ABOUT SENSATA

Sensata Technologies Holding N.V. (NYSE: ST), a global industrial technology company, is a leader in the development, manufacture and sale of sensors and controls. We produce a wide range of customized, innovative sensors and controls for mission critical applications such aelectric motors. Our high value-added solutions help satisfy the world's growing need for safety, energy efficiency, and a clean environment, positively affecting millions of people everyday.

Looking ahead, we intend to continue to execute our growth strategy, developing innovative new products; expanding our presence in significant emerging markets; broadening our already deep customer relationships; extending our low cost advantage; pursuing strategic acquisitions, and continuing to recruit, retain and develop our talented employee pool globally.

For more information about Sensata, please visit www.sensata.com.

CERAMIC CAPACITIVE PRESSURE SENSOR WITH 4...20 mA OUTPUT

87CP Series – 6...30 VDC Supply, 4...20 mA Output

ORDERING INFORMATION

Partnumber	Port	Pressure Range
87CP725M10AN	1/8 NPT	0...10 bar (Absolute)
87CP725M16GV	1/8 NPT	0...16 bar (Gauge)
87CP725M20AN	1/8 NPT	0...20 bar (Absolute)
87CP725M35AN	1/8 NPT	0...35 bar (Absolute)
87CP755M10AN	1/4" female flare	0...10 bar (Absolute)
87CP755M16AN	1/4" female flare	0...16 bar (Absolute)
87CP755M20AN	1/4" female flare	0...20 bar (Absolute)
87CP755M35AN	1/4" female flare	0...35 bar (Absolute)
87CP855M46AN	1/4" female flare	0...46 bar (Absolute)

APPLICATIONS

Pumps and compressors

- Industrial cleaning
- (Car) Washing systems
- High pressure water cleaning
- Water pumps, auxiliary pumps
- Pneumatic systems

Industrial Automation & Process Control

- Hydraulics, pneumatics
- Liquids and gases, lifts
- Test System

HVAC and Refrigeration

- Industrial refrigeration
- Building automation, heat pumps
- Food and retail refrigeration and cooling

FEATURES & BENEFITS

- Industrial CE approval, high EMI rated
- 30 V/m EMI protection
- Wide supply voltage 6...30 V_{DC}
- Reverse polarity protection up to 39 V
- 1% FS accuracy
- 2% accuracy over full temperature range
- Compact outline, brass or steel port
- IP classifications up to IP6K9 with cable
- -20...+100 °C operating temperature,(-40...+135 °C storage)
- Functional up to 125 °C with lower accuracy

MATING SEALED CONNECTOR

Parts	Partnumber	Supplier
Connector	12065286	Delphi
Terminal	12103881	Delphi
Cable-seal	12065285	Delphi
Connector-seal	12052893	Delphi

TECHNICAL SPECIFICATIONS

Pressure range

0...10, 0...20, 0...35, 0...46 bar absolute and 0...16 bar relative

Performance

- Calibration-Accuracy ±0.75% FS
- Linearity, hysteresis, repeatability, calibration
- Total error band @ 23 °C ±1% FS
- -20...+85 °C ±1.6% FS
- -20...+100 °C ±2% FS

  (Values are typical. Higher accuracies are possible, consult factory)
- Operating temperature -20...+100 °C

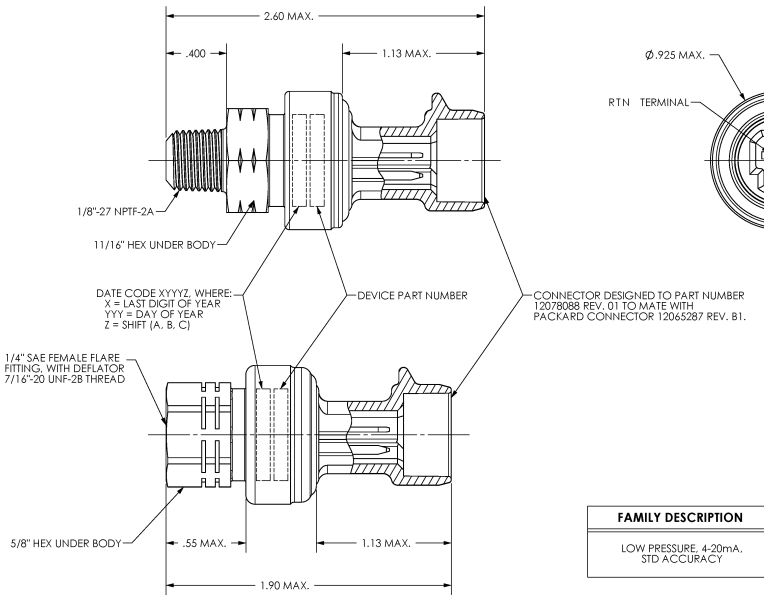
Electrical

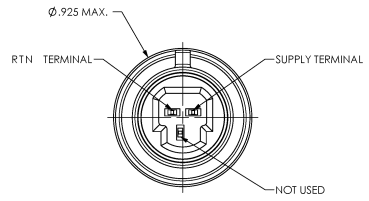
- Supply voltage 6...30 V_{DC}
- Output current 4...20 mA
- Output load (Vs-7)/0.02 Ω
- Overvoltage protection ±39 V_{DC}
- Output response 4 ms typical
- EMC (512...1GHz) 30 V/m
- EMC (10...512MHz) 100 V/m
- ESD (CDF-AEC – Q100-002) 8 kV/4kV

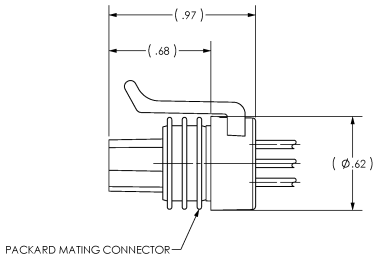
Physical

- Proof pressure: 0...10 bar 5x, 0...16 bar 5x, 0...20 bar 3x, 0...35 bar 3x, 0...46 bar 3x
- Burst pressure
  - All brass versions 105 bar
  - Steel version 150 bar
- Cycle life 10M FS Cycles
- Random vibration (50...2000 Hz) 10 g
- Mechanical shock, (6 Hz, ½ Sine) 100 g
- Drop, any axis 1.5 m
- Weight 36 gr. 1/4" female flare
  46 gr. 1/8 NPT male

ZONE	REV.	REVISION DESCRIPTION	ECN NO.	DATE
	B	ADDED CODE "V" TO PRESSURE SEALS TABLE. CODE "G" TO PRESSURE REFERENCE TABLE AND CODE "M16" TO LOW PRESSURE RANGE TABLE: TB	ECO-078421	13-JUL-2012







87CP X X 5 XXX A X

FAMILY DESCRIPTION

LOW PRESSURE, 4-20mA, STD ACCURACY

HEXPORT MATERIAL

CODE	MATERIAL
7	BRASS
8	PLATED STEEL
9	STAINLESS STEEL

HEX UNDER BODY

CODE	THREAD	HEX
2	1/8"-27 NPTF-2A	11/16" UNDER
5	7/16"-20 UNF-2B W/ DEFLATOR	5/8" UNDER

ELECTRICAL CONNECTOR

CODE	DESCRIPTION
5	TWO TAIL PACKARD CONNECTOR

MATERIAL

CONNECTOR: PPO 30% GLASS FILLED
INSULATOR: CDA 260 BRASS
TERMINALS: WITH Sn PLATE

PRESSURE SEALS

CODE	SEAL MATERIAL	SEAL TEMPERATURE
F	FLUOROSILICONE	(-45°C TO +135°C)
H	HYDROGEN'D NITRILE	(-40°C TO +135°C)
N	NEOPRENE	(-37°C TO +120°C)
V	FLUOROCARBON	(-26°C TO +135°C)

PRESSURE REFERENCE

CODE	DESCRIPTION
A	ABSOLUTE (NO VENT)
G	RELATIVE (VENT)

LOW PRESSURE RANGE

CODE	OPERATING PRESSURE
M10	00 - 10 BAR
M16	00 - 16 BAR
M20	00 - 20 BAR
M35	00 - 35 BAR
M46	00 - 46 BAR

SPECIFICATIONS	mA OUTPUT
1. POWER SUPPLY VOLTAGE	6 TO 30 VDC
2. OPERATING TEMPERATURE RANGE (SUBJECT TO SEAL MATERIAL)	-20°C TO +100°C
3. OUTPUT LOAD (WHERE Vs-ACTUAL SUPPLY V)	(Vs-7)/0.020
4. OUTPUT SPAN	4 - 20 mA
5. PERFORMANCE (STATIC ERROR BAND @ 25°C)	16.0 VDC: ±1.0% (SPAN)
6. LINEARITY	±0.75% SPAN
7. TOTAL ERROR BAND	-20°C TO +100°C ±2.00% (SPAN)
8. OVERVOLTAGE PROTECTION	39 VDC
9. PROOF PRESSURE	1.5X
10. BURST PRESSURE	3X MIN.
11. RANDOM VIBRATION	(25 - 2000 HZ): 10 GRMS
12. EMC (512 MHZ - 1 GHZ)	30 V/M
13. ESD (EN61000-4-2)	8KV IN AIR, 4KV CONTACT

FOR REFERENCE ONLY. CHECK LATEST REVISION BEFORE USE. PARTS MADE TO THIS PRINT MUST CONFORM TO E9898 REV. E.

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ENGINEER: BEN PORTEUS, DATE 12-OCT-2011
APPROVED: MELISSA SHALTIS, DATE 12-OCT-2011
APPROVED: JEFF SILVERIA, DATE 12-OCT-2011

INTERPRET DIMENSIONING AND TOLERANCING PER ASME Y14.5-2009. UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.
TOLERANCES: DECIMALS X.XXX ±.005; ANGLES X.X° ±1°

DO NOT SCALE DRAWING | THIRD ANGLE PROJECTION

DEVICE: 87CP | PROJECT: 1

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TITLE: 87CP 4-20mA LOW PRESSURE TRANSDUCER ENVELOPE DRAWING

SIZE C | DWG NO. 87CP | REV. B | SCALE 2:1 | SOLIDWORKS | SHEET 1 OF 1

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