

# Model 101PT(a19G) Pressure & Temperature Sensors

## Description

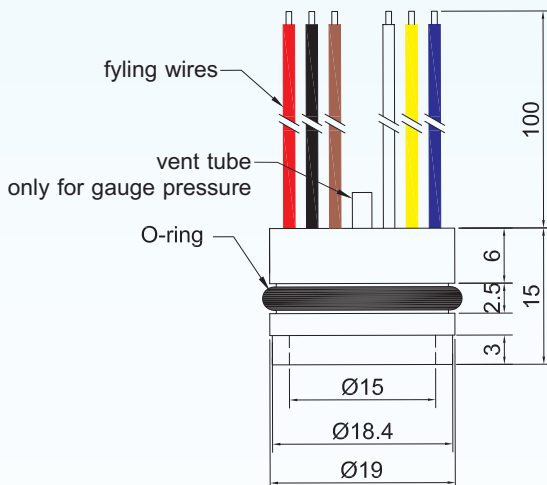
In order to measure both pressure and temperature of pressure medium simultaneously at the same point, model 101PT(a19G) Pressure & Temperature Sensor (PTS) is developed from a pressure sensor. This PTS is manufactured as either an analogue PTS or a digital PTS, depending on either a temperature sensor or a digital ASIC integrated in it. It covers a wide measuring range of pressures from 0.1bar to 1000bar, with pressure reference of gauge (relative), absolute, or sealed gauge. In meanwhile, it can measure the medium temperatures in its operating range either from -40°C to +125°C when it is the analogue PTS or from -40°C to +85°C if it is the digital PTS.

When it is manufactured as the analogue PTS, its pressure output is mV/V signal resulting from a Wheatstone bridge circuit while its temperature output from the integrated temperature sensor is either resistance change in Ohms of a Pt100, or mV signal of a thermal diode. This output signal from the temperature sensor can be used not only for sensing medium's temperatures but also for additional temperature compensation for the pressure signals by Buyer.

When it is manufactured as the digital PTS, its pressure and temperature outputs are all digital signals of either I2C or SPI, resulting from the digital ASIC.

One of the most common application of this PTS is to integrate it into a customer-tailored housing to form a customized PTS, in order to facilitate measurements of both pressure and temperature of the pressure medium simultaneously at the same point.

## Dimensions



Note: All dimensions are in mm.



## Features

- pressure range and its reference:
  - gauge: -1~0, 0~0.1, ..., ~35 bar
  - absolute: 0~0.7, ..., ~400 bar
  - sealed gauge: 0~600, ~1000 bar
- accuracy of pressure measurement up to 0.25%fs
- temperature measuring range: -40~+85 °C
- accuracy of temperature measurement up to 0.5°C
- output signal: both analogue and digital available for selection

## Applications

- pressure and temperature measuring or controlling
- industrial process controlling or monitoring systems
- pneumatic and hydraulic control systems
- pressure and temperature transducers and transmitters
- pressure and temperature calibrators

## Environmental Specifications

- position effect: < 0.1% of zero offset shift in any direction
- vibration effect: no change at 10 g (RMS), 20~2000 Hz
- shock: 100 g, for 10 millisecond

# Model 101PT(a19G)

## Pressure & Temperature Sensors

### Technical Data

#### 1) Pressure Measurements

Parameters		Units	Specifications	Notes
pressure medium			compatible with pressure diaphragm	
pressure reference & nominal ranges	gauge	bar	-1~0, 0~0.1, ~0.2, ~0.35, ~0.7, ~1, ~2, ~4, ~6, ~10, ~16, ~20, ~35	1
	absolute	bar	0~0.7, ~1, ~2, ~4, ~6, ~10, ~16, ~20, ~35, ~70, ~100, ~250, ~400	
	sealed gauge	bar	0~600, ~1000	
proof pressure		%fs	200, 150 in case of ranges $\geq$ 100bar	2
burst pressure		%fs	300, 200 in case of ranges $\geq$ 100bar	
output signal	analogue	mV	$\geq$ 60, $\geq$ 40 in case of 0.1bar range	3 & 4
	digital		I <sup>2</sup> C, SPI	5
excitation for "analogue outputs"	voltage	Vdc	5 (max. 10)	
	current	mA	1.5 (max. 2)	
power supply (Vs) for "digital outputs"		Vdc	3, ..., 5	
zero offset for "analogue outputs"		mV	$\leq$ $\pm$ 2	4
accuracy		%fs	$\pm$ 0.25 (standard), $\pm$ 0.5	6
long-term stability		%fs/year	$\leq$ $\pm$ 0.1, $\leq$ $\pm$ 0.2 (ranges < 2bar, or > 250bar)	
input resistance for "analogue output"		k $\Omega$	5 $\pm$ 3	
output resistance for "analogue output"		k $\Omega$	4.5 $\pm$ 1.5	
insulation resistance		M $\Omega$	$\geq$ 100 @250Vdc	
compensated temperature range		°C	0~50 ( $\leq$ 2bar), -10~+70 (> 2bar)	
operating temperature range		°C	-40 ~ +125, -40 ~ +85 in case of "digital outputs"	
storage temperature range		°C	-40 ~ +125, -40 ~ +85 in case of "digital outputs"	
temperature drift of zero offset		%fso	$\leq$ $\pm$ 0.75 (> 2bar), $\leq$ $\pm$ 0.8 (0.35bar, ..., 2bar), $\leq$ $\pm$ 1.2 (< 0.35bar)	4 & 7
temperature drift of span		%fso	$\leq$ $\pm$ 0.75 (> 2bar), $\leq$ $\pm$ 0.8 (0.35bar, ..., 2bar), $\leq$ $\pm$ 1.2 (< 0.35bar)	4 & 7
life time		cycles	10 <sup>8</sup>	
response time		ms	$\leq$ 1	8
process sealing			O-ring (fluorine rubber), O-ring with PVDF washer ( $\geq$ 250bar)	
electrical interface	standard		colored flying wires, insulation = silicone rubber, length = 100mm	9
	option		flexible flat cable, 15mm	9
pressure diaphragm			316L SS	
housing material			316L SS	
filling oil			silicone oil	
net weight		gram	~16.5 ( $\leq$ 100bar), ~25 ( $\geq$ 200bar)	

General conditions for measurements: media temp. = 25°C  $\pm$ 1°C, ambient temp. = 25°C  $\pm$ 1°C, humidity = 50%RH  $\pm$ 5%RH,  
barometric pressure: 860~1060 mbar, max. vibration = 0.1 g (i.e. 0.98m/s/s).

- Notes:
- The listed ranges are designed ranges, or nominal ranges. For customized ranges, consult BCM.
  - "fs" refers to full scale pressure.
  - Measured at fs, i.e. full scale pressure.
  - Measured at 5Vdc excitation.
  - A PCB of sensor signal conditioner is attached to the backside of sensor.
  - Accuracy = sqrt (non-linearity<sup>2</sup> + hysteresis<sup>2</sup> + repeatability<sup>2</sup>).
  - Calculated as the maximum change of output signal over the compensated temperature range.
  - The response time is measured in the leading edge (i.e., rising time) from 10%fs to 90%fs.
  - There are four conductors in case of mV output and for I<sup>2</sup>C protocol, or six conductors in case of SPI protocol.

# Model 101PT(a19G) Pressure & Temperature Sensors

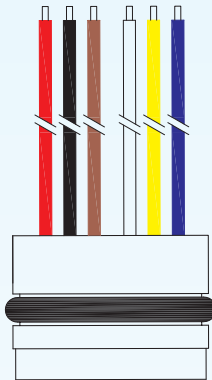
## 2) Temperature Measurements

Parameters	Units	Specifications			Notes
type of temperature sensors		thermal diode	Pt100	digital temperature sensor in ASIC	1
nominal ranges	°C	-40 ~ +125	-40 ~ +125	-40 ~ +85	
sensitivity		2mV/°C	3850ppm/°C	4.8count/°C	
accuracy	°C	better than ±1	better than ±0.35	better than ±0.5	2
electrical interface		two electric wires		same wires as are used for pressure output	3

- Notes:
1. The digital temperature sensor is only available for selection when this PTS is manufactured as the digital PTS.
  2. The accuracy of Pt100 is compliant with Class A of IEC 751, i.e.,  $\pm 0.15^{\circ}\text{C}@0^{\circ}\text{C}$  and  $\pm 0.35^{\circ}\text{C}@100^{\circ}\text{C}$ .
  3. When this PTS is manufactured as the digital PTS, its temperature output signal will appear in time sequence in respect to the pressure output signal, and come along the same electric wires, i.e., four wires for I2C or six wires for SPI protocol.

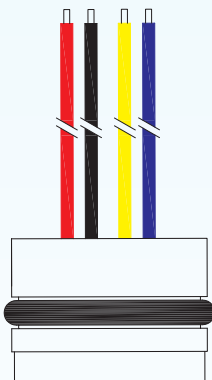
## Electrical Interface

### 1) Six wires for analogue PTS or digital PTS of SPI protocol



wire color	millivolt with TD/Pt100	I <sup>2</sup> C with TD/Pt100
red	excitation +	power +
black	excitation -	GND
yellow	signal +	SCL
blue	signal -	SDA
brown	temp. +	temp. +
white	temp. -	temp. -

### 2) Four wires for digital PTS of I<sup>2</sup>C protocol



wire color	I <sup>2</sup> C with its own integrated temp. sensor
red	power +
black	GND
yellow	SCL
blue	SDA

Notes: For each delivered sensor, its electrical definition will be indicated on the label of the package.

# Model 101PT(a19G) Pressure & Temperature Sensors



## Ordering Information

### 1) Analogue PTS of Analogue Output

<b>position (pos.) 1: model</b>							
101PT(a19G)							
<b>pos. 2: nominal pressure ranges vs measuring ranges (&amp;)</b>						<b>pressure references</b>	
(-0.1/+0.1)bar	G	(-1/+2)bar	G	0/0.7barA	0/20bar A	0/600bar S	G: gauge pressure
(-0.2/+0.2)bar	G	(-1/+4)bar	G	0/1bar A	0/35bar A	0/1000bar S	A: absolute pressure
(-0.35/+0.35)bar	G	(-1/+6)bar	G	0/2bar A	0/70bar A		S: sealed gauge
(-0.7/+0.7)bar	G	(-1/+10)bar	G	0/4bar A	0/100bar A		
(-1/+1)bar	G	(-1/+16)bar	G	0/6bar A	0/250bar A		
		(-1/+20)bar	G	0/10bar A	0/400bar A		
		(-1/+35)bar	G	0/16bar A			
<p>(&amp;): Any nominal range as listed above is a designed range or a physical capacity of a corresponding sensor, which is also called the full scale (fs) of this sensor. The measuring range is a range of physical quantity which Buyer wants to measure or monitor, and must be either within or maximum equal to the nominal range of the selected sensor. A right sensor can be selected if its nominal range just covers the measuring range in Buyer's application.          If Buyer purchases a sensor of "mV" output signal, Buyer has to indicate its nominal range for "pos. 2" in Ordering Code.          For example, if Buyer wants to purchase a sensor to measure or monitor pressure from -0.5 bar to 4.5 bar, he needs to purchase a sensor of the nominal range of (-1/+6)barG from the list, because this nominal range does suitably cover the measuring range of -0.5 bar to 4.5 bar. To do so, he has to indicate (-1/+6)barG in Ordering Code for "pos. 2". As a result, when using this sensor in his application, Buyer will obtain an output signal of "-5mV (^)" when the measured pressure is "-0.5 bar" while "+45mV (^)" when the measured pressure is "+4.5 bar".          Another example is that, if Buyer wants to measure or monitor pressure from 0 bar to 15 bar in his application, he needs to purchase a sensor of the nominal range of (-1/+16)barG from the list, because this nominal range does suitably cover the measuring range from 0 bar to 15 bar. To do so, he has to indicate (-1/+16)barG for "pos. 2" in Ordering Code. As such, when using this sensor in his application, Buyer will have an output signal of "<math>\leq \pm 2mV</math> (^)" when the measured pressure is "0 barG" while "56.25mV (^)" when the measured pressure is "15 barG".          (^): The "60mV" is the output of the "fs" when a sensor is excited by 5Vdc, while the "<math>\leq \pm 2mV</math>" is the offset of the sensor.</p>							
<b>pos. 3: output signal</b>							
40mV for range of 0.1bar; 60mV for other ranges							
<b>pos. 4: accuracy</b>							
0.25%fs (standard)				0.5%fs			
<b>pos. 5: temperature sensor and its measuring range (&amp;&amp;)</b>							
TD = Thermal Diode calibrated to its nominal range of -40 ~ +125°C which Buyer has chosen.							
TD(0/100)C = Thermal Diode calibrated from 0 to 100°C as defined by Buyer.							
Pt100 = Pt100 calibrated to its nominal range of -40 ~ +125°C which Buyer has chosen.							
Pt100(-35/+105)C = Pt100 calibrated from -35 to +105°C as defined by Buyer.							
(&&): Either a TD or a Pt100 is selected with a measuring range defined by Buyer, the measuring range must be either within or maximum equal to the nominal range of the selected sensor (refer to the table of Temperatures Measurement as listed in page 3). If Buyer does not indicate the measuring range, the sensor will be calibrated to its nominal range. The calibration data of output signals corresponding to the measuring range can be requested as a customized specification (see "pos. 8") and supplied as additional service with the purchased PTS.							
<b>pos. 6: electrical interface</b>							
FW (standard): colored PVC flying wires of 100mm length (#)							
FC: flat cable of 100mm length (#)							
(#): This is the standard length, but Buyer can specify a desired length according to his application by adding relevant figures after "FW" or "FC". For instance, "FW(150mm)" defines "colored PVC flying wires of 150 mm length", while "FC(300mm)" refers to "flat cable of 300 mm length", and so on.							
<b>pos. 7: excitation</b>							
v = 5Vdc (standard)				c = 1.5mA			
<b>pos. 8: customized specifications</b>							
If Buyer wants one or more customized specifications, he can indicate "(*), (**), (***)" as the code(s) at the end of the Ordering Code, and further define what is (are) the specific customized specification(s) for "*" (and "**", "**...", "..."). If there is no customized specification, the "pos. 8" is omitted. For precise understanding how to define "pos. 8", refer to the Examples of Ordering Code below.							
pos.1	pos. 2	pos. 3	pos. 4	pos. 5	pos. 6	pos. 7	pos. 8

# Model 101PT(a19G) Pressure & Temperature Sensors



## Examples of Ordering Code

- standard sensor:

**101PT(a19G)-(-0.2/+0.2)barG-60mV-0.25%fs-TD-FW-v**

**101PT(a19G)-(-1/+6)barG-60mV-0.25%fs-TD(-10/100)C-FW(150mm)-v**

**101PT(a19G)-0/6barA-60mV-0.25%fs-Pt100(0/125)C-FW(200mm)-v**

- customized sensor:

**101PT(a19G)-0/6barA-60mV-0.25%fs-TD(0/125C)-FW(200mm)/Molex0430250600-v-(\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

**101PT(a19G)-0/6barA-60mV-0.25%fs-TD(0/125C)-FW(200mm)/Molex0430250600-v-(\*)-(\*\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

(\*\*) = The calibration data of output signals corresponding to the measuring range of pressures has to be supplied with the purchased PTS.

**101PT(a19G)-0/6barA-60mV-0.25%fs-TD(0/125C)-FW(200mm)/Molex0430250600-v-(\*)-(\*\*)-(\*\*\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

(\*\*) = The calibration data of output signals corresponding to the measuring range of pressures has to be supplied with the purchased PTS.

(\*\*\*) = The calibration data of output signals corresponding to the measuring range of temperatures has to be supplied with the purchased PTS.

To be continued in the next page is Ordering Information of digital PTS.

# Model 101PT(a19G) Pressure & Temperature Sensors



## 2) Digital PTS of Output either I<sup>2</sup>C or SPI Protocol

position (pos.) 1: model						
101PT(a19G)						
pos. 2: nominal pressure ranges vs measuring ranges (^)						pressure references
(-0.1/+0.1)bar	G	(-1/+2)bar	G	0/0.7bar	A	0/600bar S
(-0.2/+0.2)bar	G	(-1/+4)bar	G	0/1bar	A	0/1000bar S
(-0.35/+0.35)bar	G	(-1/+6)bar	G	0/2bar	A	0/70bar A
(-0.7/+0.7)bar	G	(-1/+10)bar	G	0/4bar	A	0/100bar A
(-1/+1)bar	G	(-1/+16)bar	G	0/6bar	A	0/250bar A
		(-1/+20)bar	G	0/10bar	A	0/400bar A
		(-1/+35)bar	G	0/16bar	A	
(&): Any nominal range as listed above is a designed range or a physical capacity of a corresponding sensor, which is also called the full scale (fs) of this sensor. The measuring range is a range of physical quantity which Buyer wants to measure or monitor, and must be either within or maximum equal to the nominal range of the selected sensor. A right sensor can be selected if its nominal range just covers the measuring range in Buyer's application. If Buyer purchases a sensor of either the ratiometric output or the digital signal of I2C (or SPI) protocol, Buyer has to indicate the measuring range of his application for "pos. 2" in Ordering Code, rather than the sensor's nominal range. For example, suppose the measuring range in Buyer's application is still from -0.5 bar to +4.5 bar but Buyer wants I2C protocol as sensor's output. In this case Buyer has to indicate the measuring range of (-0.5/+4.5)barG for "pos. 2" when he defines Ordering Code. After having this done, with the selected sensor Buyer can obtain an output of "1638 counts (^^^)" when the measured pressure is "-0.5 barG" while "14746 counts (^^^)" when the measured pressure is "+4.5 barG". (^^^): The "1638 counts" corresponds to the lowest limit while the "14746 counts" corresponds to the highest limit of the measuring range.						
pos. 3: output signal						
I2C			SPI			
pos. 4: accuracy						
0.25%fs (standard)			0.5%fs			
pos. 5: digital temperature sensor and its measuring range						
TI = The sensor is calibrated to its nominal range of -40 ~ +85°C which Buyer has chosen. TI(-35/+70)C = The sensor is calibrated from -35 to +70 as defined by Buyer (^). (^): The "(-35/+70)C" is the measuring range and is indicated by Buyer according to his application. The measuring range must be either within or maximum equal to the nominal range from -40 to +85°C of the sensor (refer to the table of Temperatures Measurement as listed in page 3). Buyer has to indicate exactly the measuring range of temperatures in his application for "pos. 5" in the Ordering Code. For example if "TI(-10/+60)C" is indicated in the Ordering Code for "pos. 5", before this sensor is delivered to Buyer, it will be calibrated with its temperature output signal of "420 counts" corresponding to -10°C while "1020 counts" corresponding to +60°C. The calibration data of output signals corresponding to the measuring range can be requested as a customized specification (see "pos. 8") and supplied as additional service with the purchased PTS.						
pos. 6: electrical interface						
FW (standard): colored PVC flying wires of 100mm length (#) FC: flat cable of 100mm length (#) (#): This is the standard length, but Buyer can specify a desired length according to his application by adding relevant figures after "FW" or "FC". For instance, "FW(150mm)" defines "colored PVC flying wires of 150 mm length", while "FC(300mm)" refers to "flat cable of 300 mm length", and so on.						
pos. 7: customized specifications						
If Buyer wants one or more customized specifications, he can indicate "(*)", "(**)", "(***)" as the code(s) at the end of the Ordering Code, and further define what is (are) the specific customized specification(s) for "*" (and "**", "***", ...). If there is no customized specification, the "pos. 8" is omitted. For precise understanding how to define "pos. 8", refer to the Examples of Ordering Code below.						
pos.1	pos.2	pos.3	pos.4	pos.5	pos.6	pos.7

# Model 101PT(a19G) Pressure & Temperature Sensors



## Examples of Ordering Code

- standard sensor:

**101PT(a19G)-0/5barA-I2C-0.25%fs-TI(-10/+50)C-FW**

**101PT(a19G)-(-1/+5)barG-I2C-0.25%fs-TI(-10/+65)C-FW**

**101PT(a19G)-(-1/+5)barG-I2C-0.25%fs-TI(-10/+85)C-FW(200mm)**

- customized sensor:

**101PT(a19G)-(-1/+5)barG-SPI-0.25%fs-TI(-40/+85)C-FW(200mm)/Molex0430250600-v-(\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

**101PT(a19G)-(-1/+5)barG-SPI-0.25%fs-TI(-40/+85)C-FW(200mm)/Molex0430250600-v-(\*)-(\*\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

(\*\*) = The calibration data of output signals corresponding to the measuring range of pressures has to be supplied with the purchased PTS.

**101PT(a19G)-(-1/+5)barG-SPI-0.25%fs-TI(-40/+85)C-FW(200mm)/Molex0430250600-v-(\*)-(\*\*)-(\*\*\*)**

(\*) = An Molex plug of P/N 0430250600 has to be attached at the end of flying wires.

(\*\*) = The calibration data of output signals corresponding to the measuring range of pressures has to be supplied with the purchased PTS.

(\*\*\*) = The calibration data of output signals corresponding to the measuring range of temperatures has to be supplied with the purchased PTS.

The listed specifications, dimensions, and ordering information are subject to change without prior notice.

**BCM SENSOR TECHNOLOGIES BV**



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