

### FEATURES

- 200 mbar to 35 bar, 3 to 500 psi absolute, gage or vacuum pressure (custom pressure ranges on request)
- Amplified analog output and I<sup>2</sup>C bus interface (SPI on request)
- Precision ASIC signal conditioning
- Calibrated and temperature compensated
- Rugged stainless steel isolated package
- RoHS compliant
- Quality Management System according to ISO 13485:2003 and ISO 9001:2008



### MEDIA COMPATIBILITY

Wetted materials:  
Stainless steel 316/316 L

### SPECIFICATIONS

#### Maximum ratings

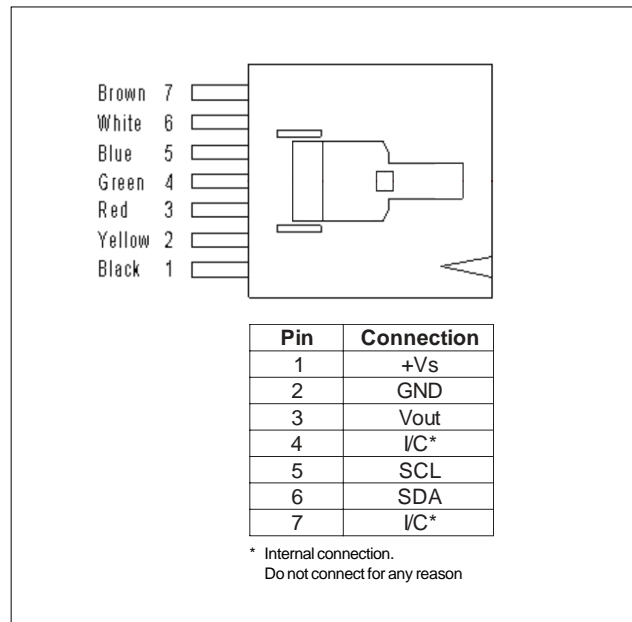
Supply voltage  $V_s$  4.5 V ... 5.5 V<sub>DC</sub>  
max. 6.50 V<sub>DC</sub>

Temperature ranges  
Compensated -20 ... +85 °C  
Operating -40 ... +120 °C  
Storage -40 ... +120 °C

Insulation resistance 100 MΩ at 100 V<sub>DC</sub>

Proof pressure<sup>1</sup> 2 x rated pressure  
Burst pressure<sup>2</sup> 4 x rated pressure

### ELECTRICAL CONNECTION



# SSI Series

## Amplified stainless steel pressure sensors

### PERFORMANCE CHARACTERISTICS

( $V_S = 5.0 V_{DC}$ ,  $T_A = 25^\circ C$ , analog output signal is **ratio metric** to  $V_S$ , digital output signal is **not ratio metric** to  $V_S$ )

Characteristics	Min.	Typ.	Max.	Units
Total accuracy (-20...85 °C) <sup>4</sup>			±1.5	%FSS
Response delay <sup>5, 6</sup>		2		ms
A/D resolution <sup>6</sup>		13		bit
D/A resolution			11	
Current consumption <sup>7</sup>		5		mA
ANALOGUE PERFORMANCE CHARACTERISTIC				
Output at min. specified pressure	0.44	0.50	0.56	V
Full scale span (FSS) <sup>3</sup>		4.00		
Full scale output	4.44	4.50	4.56	
DIGITAL PERFORMANCE CHARACTERISTIC				
Output at min. specified pressure	2883	3277	3670	counts
Full scale span (FSS) <sup>3</sup>		26214		
Full scale output	29097	29490	29883	

#### Specification notes:

1. Proof pressure is the maximum pressure which may be applied without causing durable shifts of the electrical parameters of the sensing element.
2. Burst pressure is the maximum pressure which may be applied without causing damage to the sensing element or leaks to the housing.
3. Full Scale Span (FSS) is the algebraic difference between the output signal for the highest and lowest specified pressure.
4. Total accuracy is the combined error from offset and span calibration, linearity, pressure hysteresis, and temperature effects. Linearity is the measured deviation based on a straight line. Hysteresis is the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure. Calibration errors include the deviation of offset and full scale from nominal values.
5. Max. delay time between pressure change at the pressure die and signal change at the output.
6. The response time depends on the adjusted internal A/D resolution of the sensor. For 13 bit it is typ. 2 ms. Other A/D resolutions and response time are available on request. Please contact First Sensor for further information.
7. Sensors with lower current consumption are available on request. Please contact First Sensor for further information.

## I<sup>2</sup>C BUS

### Introduction

The sensor is capable to generate a digital output signal. The device runs a cyclic program, which will store a corrected pressure value with 13 bit resolution about every 500  $\mu$ s within the output registers of the internal ASIC. In order to use the sensor for digital signal readout, it should be connected to a bidirectional I<sup>2</sup>C-bus.

According to the I<sup>2</sup>C-bus specification, the bus is controlled by a master device, which generates the clock signal, controls the bus access and generates START and STOP conditions. The sensor is designed to work as a slave, hence it will only respond to requests from a master device.

### Digital I<sup>2</sup>C interface

The sensor complies with the following protocol (Fig. 1):

**Bus not busy:** During idle periods both data line (SDA) and clock line (SCL) remain HIGH.

**START condition (S):** HIGH to LOW transition of SDA line while clock (SCL) is HIGH is interpreted as START condition. START conditions are always generated by the master. Each initial request for a pressure value has to begin with a START condition.

**STOP condition (P):** LOW to HIGH transition of SDA line while clock (SCL) is HIGH determines STOP condition. STOP conditions are always generated by the master. More than one request for the current pressure value can be transmitted without generation of intermediate STOP condition.

**DATA valid (D):** State of data line represents valid data when, after START condition, data line is stable for duration of HIGH period of clock signal. Data on line must be changed during LOW period of clock signal. There is one clock pulse per bit of data.

**Acknowledge (A):** Data is transferred in pieces of 8 bits (1 byte) on serial bus, MSB first. After each byte receiving device – whether master or slave – is obliged to pull data line LOW as acknowledge for reception of data. Master must generate an extra clock pulse for this purpose. When acknowledge is missed, slave transmitter becomes inactive. It is on master either to send last command again or to generate STOP condition in that case.

**Slave address:** The I<sup>2</sup>C-bus master-slave concept requires a unique address for each device. The sensor has a preconfigured slave address (1111000xb). By factory programming it is possible to define a secondary slave address additional to the general one. According to I<sup>2</sup>C specification 127 different addresses are available. The sensor will then listen to both slave addresses. After generating a START condition the master sends the address byte containing a 7 bit address followed by a data direction bit (R/W). A "0" indicates a transmission from master to slave (WRITE), a "1" indicates a data request (READ).

**DATA operation:** The sensor starts to send 2 data bytes containing the current pressure value as a 15 bit information placed in the output registers.

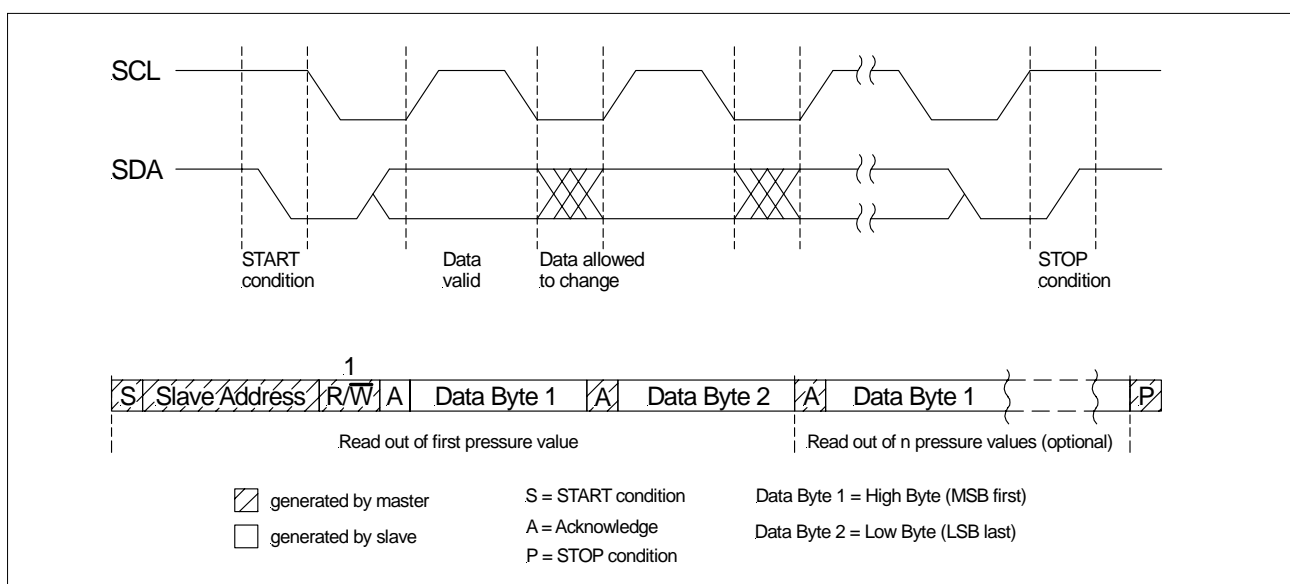


Fig. 1: I<sup>2</sup>C bus protocol

I<sup>2</sup>C Interface Parameters

Parameter	Symbol	Min.	Typ.	Max.	Unit
Input high level		90		100	% of V <sub>S</sub>
Input low level		0		10	
Output low level				10	
Pull-up resistor		500			Ω
Load capacitance @ SDA	C <sub>SDA</sub>			400	pF
Input capacitance @ SDA/SCL	C <sub>I2C_IN</sub>			10	
SCL clock frequency	F <sub>SCL</sub>	100*		400	kHz
Bus free time between STOP and START condition	t <sub>BUF</sub>	1.3			μs
Hold time (repeated) START condition, to first clock pulse	t <sub>HD,STA</sub>	0.8			
LOW period of SCL	t <sub>LOW</sub>	1.3			
HIGH period of SCL	t <sub>HIGH</sub>	0.6			
Setup time repeated START condition	t <sub>SU,STA</sub>	1			
Data hold time	t <sub>HD,DAT</sub>	0			
Data setup time	t <sub>SU,DAT</sub>	0.2			
Rise time of both SDA and SCL	t <sub>R</sub>			0.3	
Fall time of both SDA and SCL	t <sub>F</sub>			0.3	
Setup time for STOP condition	t <sub>SU,STO</sub>	0.6			

\* recommended

**Note:** First Sensor recommends communication speeds of at least 100 kHz (max. 400 kHz). Please contact First Sensor for further information.

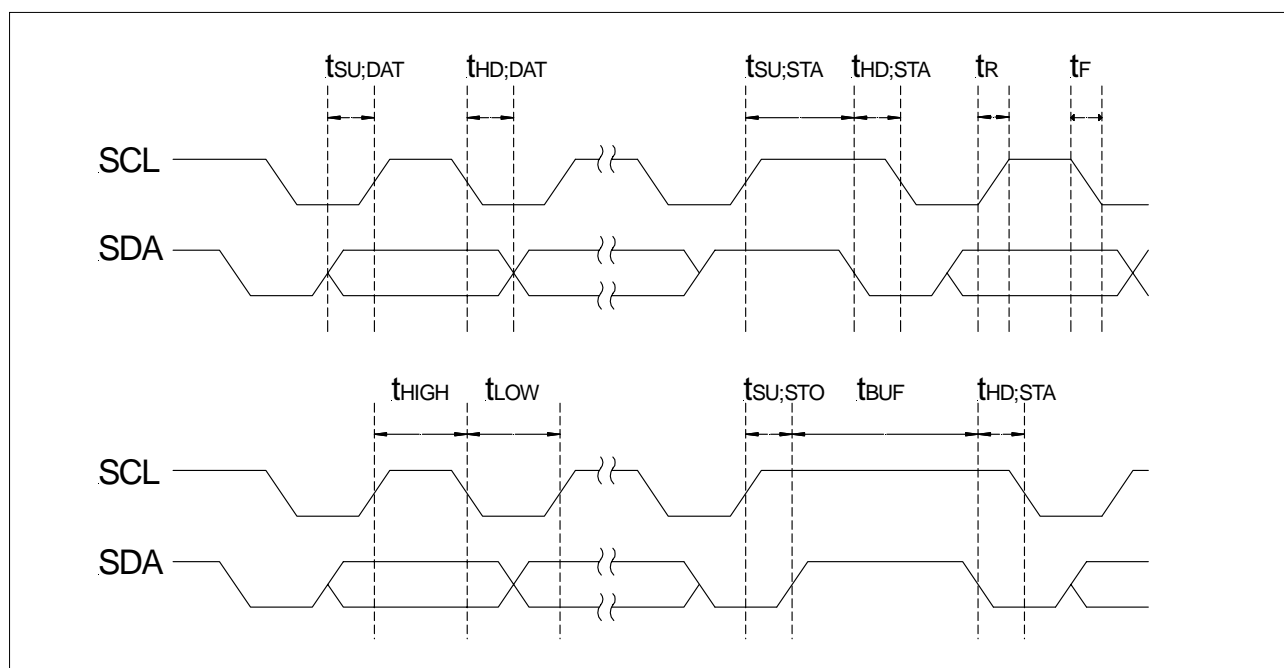
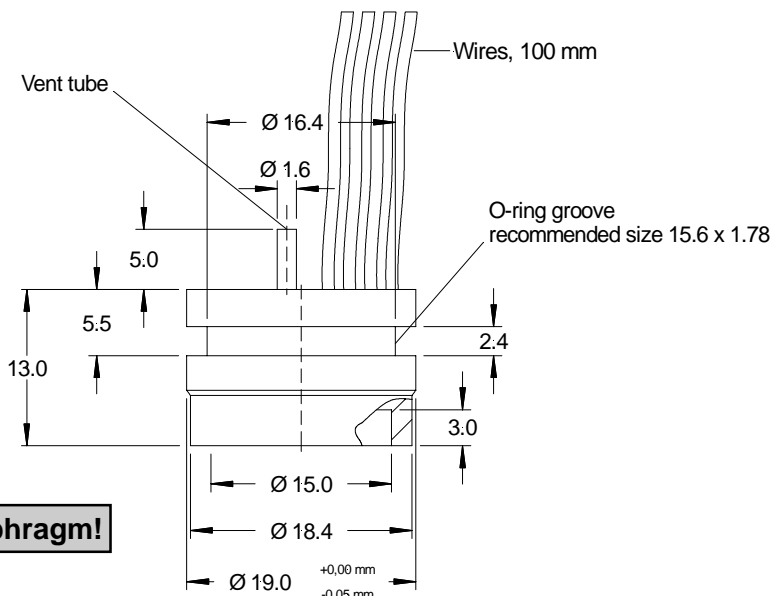


Fig. 2: Timing characteristics

### PHYSICAL DIMENSIONS

#### SSI...1 (weld ring)

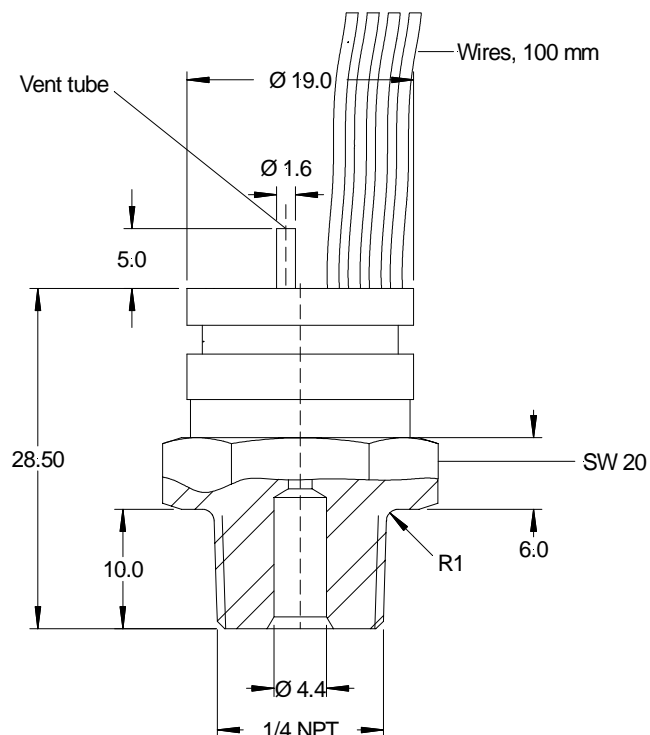


mass: approx. 17 g

dimensions in mm

A clearance fit 19H8 with 20 ° phase is recommended for mounting.

#### SSI...5 (1/4 " NPT)

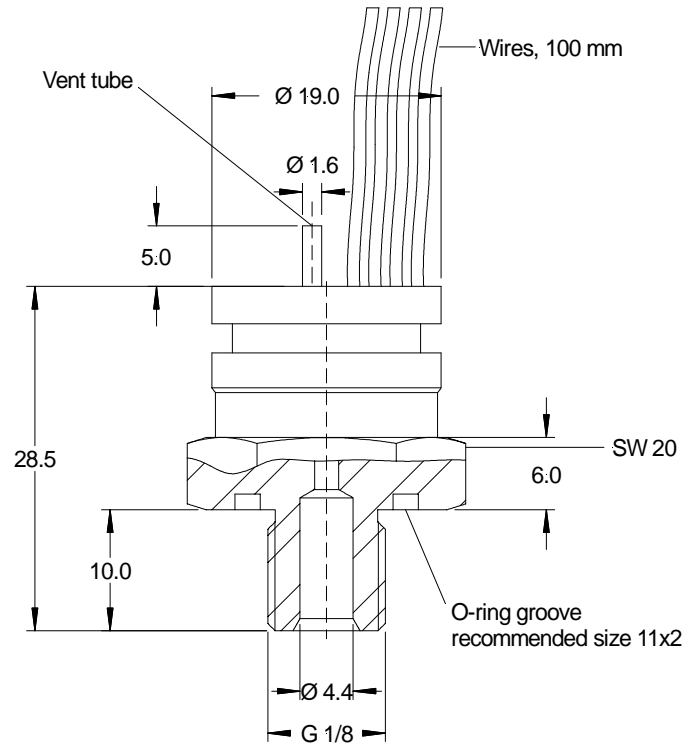


mass: approx. 50 g

dimensions in mm

### PHYSICAL DIMENSIONS

#### SSI...9 (G 1/8 " HEX)

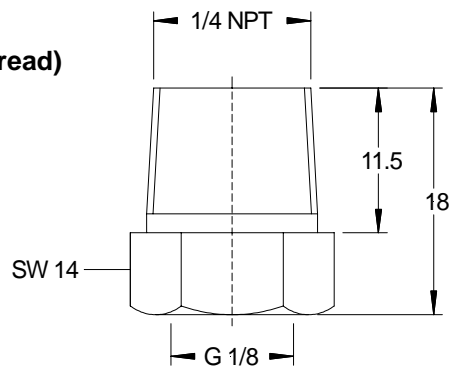


mass: approx. 35 g

dimensions in mm

### OPTIONAL PRESSURE FITTING

#### SSI...N (1/4 " NPT fitting for G 1/8 " thread)



Other fittings are available on request. Please contact First Sensor.

### ORDERING INFORMATION

Series		Pressure range		Pressure mode		Calibration		Housing		Electrical connection		Grade		Supply	
Options	SSI	M200	200 mbar	A*	Absolute	B*	Bidirectional	1	Weld ring	A	AMP-MODU*	H	High	5	5 V
		M700	700 mbar	G	Gage	U	Unidirectional	5	1/4" NPT						
		B001	1 bar			V**	Vacuum	9	G 1/8" HEX						
		B3x5	3.5 bar					N*	1/4" NPT fitting						
		B010	10 bar												
		B020	20 bar												
		B035	35 bar												
		P003	3 psi												
		P010	10 psi												
		P015	15 psi												
		P050	50 psi												
		P150	150 psi												
		P300	300 psi												
P500	500 psi														
				* only available from 700 mbar.		* only available up to 1 bar ** only available as SSIM200GV... (0...-200 mbar)		* 1/4" NPT fitting on G 1/8" thread		*TYCO 5-103956-6					
Example:		SSI	B001	G		U		9		A		H		5	
Devices highlighted in grey are preferred items.								For all other devices MOQ may apply.							

Custom pressure ranges and other fittings are available on request. MOQ applies. Contact First Sensor.

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