

## FEATURES

- Weldable or threaded process fittings
- $\pm 0.25\%$  Accuracy
- $\pm 1.0$  Total Error Band
- Cable/connector option
- Low power option
- I<sup>2</sup>C or SPI Interface protocols

## APPLICATIONS

- Level controls
- Tank level measurement
- Corrosive fluids and gas measurement systems
- Sealed systems
- Manifold pressure measurement
- Barometric pressure measurement
- Submersible depth monitoring

## 85BSD

### Digital Output

### SPECIFICATIONS

- Weldable or threaded process fittings
- Pressure/temperature read-out
- Digital output
- ASIC calibrated
- Absolute, gage
- Cable/connector option
- Low power option
- 13mm diaphragm diameter

The 85BSD is a small profile, media compatible, piezoresistive silicon pressure sensor packaged in a 316L stainless steel housing. This 14-bit digital output pressure sensor supports I<sup>2</sup>C and SPI interface protocols in either a 3.3 or 5.0Vdc supply voltage, and is designed to be weldable or threaded with process fittings. The sensing package utilizes silicone oil to transfer pressure from the 316L stainless steel diaphragm to the sensing element.

The 85BSD is designed for high performance, low pressure applications. A custom ASIC is used for temperature compensation, offset correction, and provides a digital output of 10~90% or 5~95%.

For a similar sensor with O-ring mounting, refer to the 86BSD digital output pressure sensor

## STANDARD RANGES

| Range    | psiG | psiA | Range    | barG | barA |
|----------|------|------|----------|------|------|
| 0 to 005 | •    |      | 0 to .35 | •    |      |
| 0 to 015 | •    | •    | 0 to 001 | •    | •    |
| 0 to 030 | •    | •    | 0 to 002 | •    | •    |
| 0 to 050 | •    | •    | 0 to 005 | •    | •    |
| 0 to 100 | •    | •    | 0 to 007 | •    | •    |
| 0 to 150 | •    | •    | 0 to 010 | •    | •    |
| 0 to 200 | •    | •    | 0 to 014 | •    | •    |
| 0 to 300 | •    | •    | 0 to 020 | •    | •    |

Intermediate pressure ranges available, contact factory

## PERFORMANCE SPECIFICATIONS

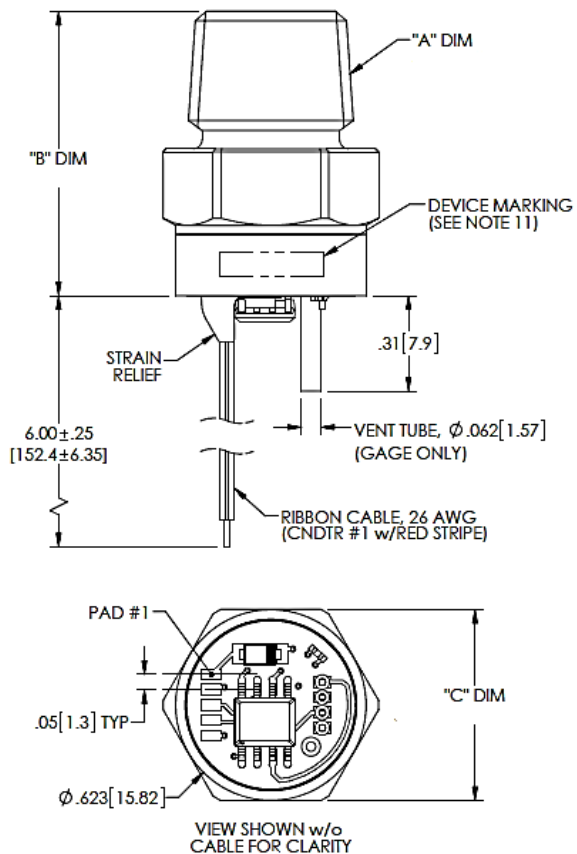
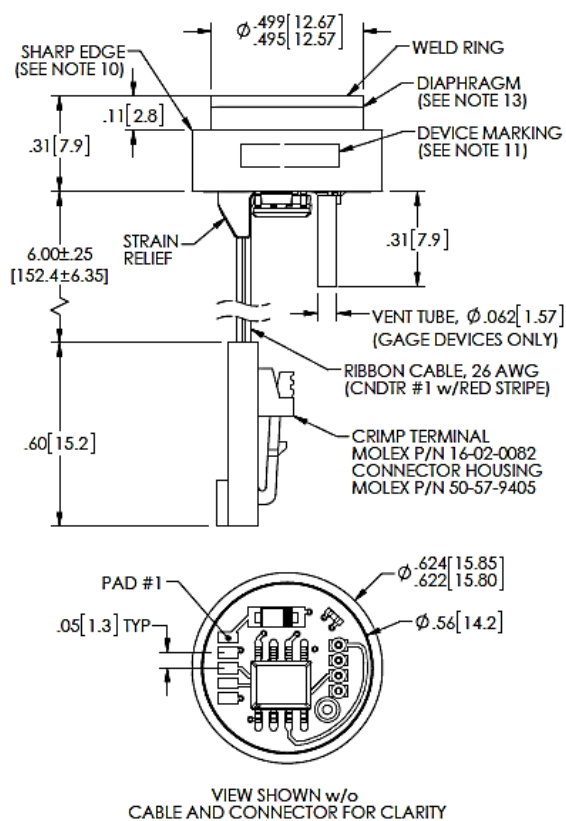
Unless otherwise specified: Supply Voltage: 3.3V<sub>DC</sub>, Ambient Temperature: 25°C

| PARAMETERS                             | MIN                                                        | TYP  | MAX  | UNITS      | NOTES |
|----------------------------------------|------------------------------------------------------------|------|------|------------|-------|
| Zero Pressure Output (10% ~ 90%)       |                                                            | 666  |      | Count Hex  | 1     |
| Zero Pressure Output (5% ~ 95%)        |                                                            | 333  |      | Count Hex  | 1     |
| Full Scale Pressure Output (10% ~ 90%) |                                                            | 399A |      | Count Hex  | 1     |
| Full Scale Pressure Output (5% ~ 95%)  |                                                            | 3CCB |      | Count Hex  | 1     |
| Accuracy                               | -0.25                                                      |      | 0.25 | %Span      | 2     |
| Total Error Band                       | -1                                                         |      | 1    | %Span      | 3     |
| Pressure Resolution                    | 0.008                                                      |      |      | %Span      |       |
| Temperature Accuracy                   | -1.5                                                       |      | 1.5  | °C         | 4     |
| Temperature Resolution                 |                                                            | 0.1  |      | °C         |       |
| Input Voltage Range                    | 2.7                                                        | 3.3  | 5.5  | V          | 1     |
| Supply Current                         |                                                            | 3    |      | mA         |       |
| Insulation Resistance (50Vdc)          | 50                                                         |      |      | MΩ         | 5     |
| Overpressure                           |                                                            |      | 2X   | Rated      | 6     |
| Burst Pressure                         |                                                            |      | 3X   | Rated      | 7     |
| Load Resistance (R <sub>L</sub> )      | 10                                                         |      |      | KΩ         |       |
| Long Term Stability (Offset & Span)    |                                                            | ±0.5 |      | %Span/Year |       |
| Compensated Temperature (≤5psi)        | 0                                                          |      | 50   | °C         |       |
| Compensated Temperature (≥15psi)       | -20                                                        |      | +85  | °C         |       |
| Operating Temperature                  | -40                                                        |      | +125 | °C         | 8     |
| Storage Temperature                    | -40                                                        |      | +125 | °C         | 8     |
| Output Pressure Resolution             |                                                            |      | 14   | Bits       |       |
| Output Temperature Resolution          | 8                                                          |      | 11   | Bits       |       |
| Start Time to Data Ready               |                                                            |      | 8.4  | ms         | 9     |
| Output Type                            | 10% to 90% or 5% to 95%                                    |      |      |            |       |
| Interface Type                         | I <sup>2</sup> C (ADDR, 0x28H)                             |      |      |            |       |
|                                        | I <sup>2</sup> C (ADDR, 0X36H)                             |      |      |            |       |
|                                        | I <sup>2</sup> C (ADDR, 0x46H)                             |      |      |            |       |
|                                        | SPI                                                        |      |      |            |       |
| Media – Pressure                       | Liquids and gases compatible with 316/316L Stainless Steel |      |      |            |       |

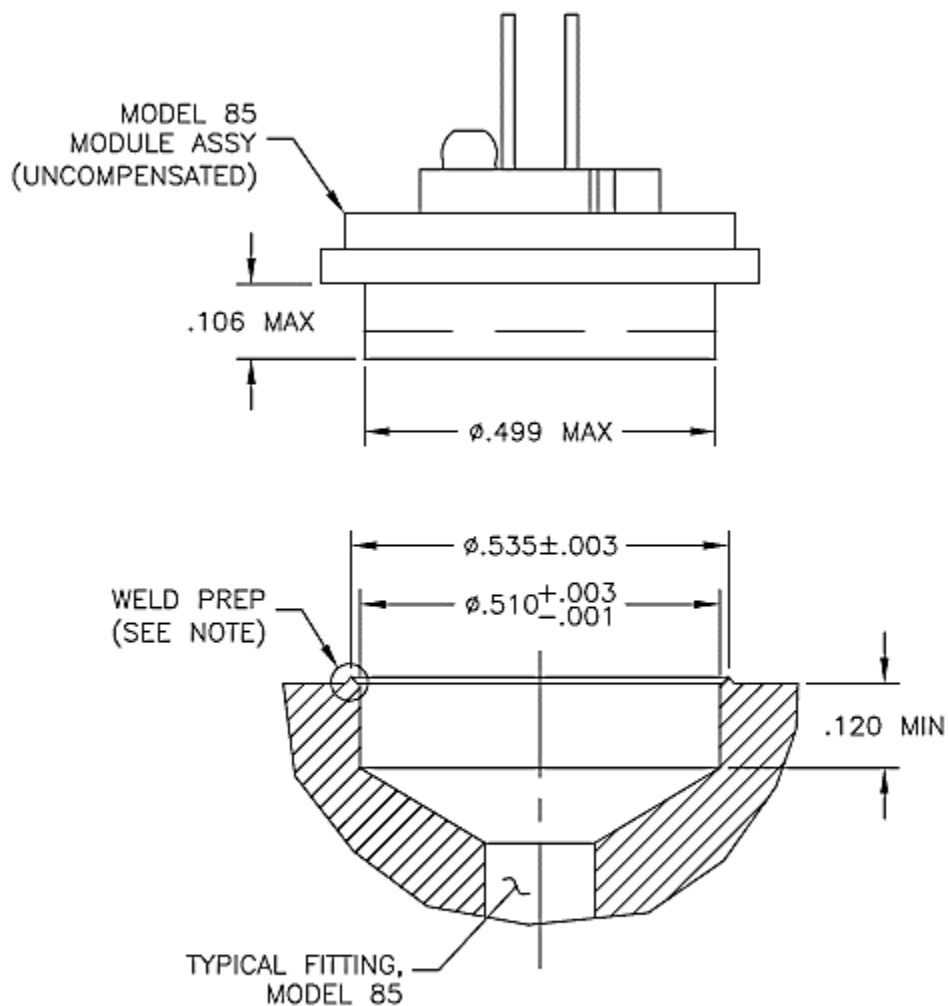
#### Notes

1. Measured at vacuum for absolute(A), ambient for gage(G) and sealed gage(S). Output is not ratiometric to supply voltage.
2. Accuracy: combined linearity, hysteresis and repeatability.
3. Total Error Band: includes calibration errors and temperature effects over the compensated range. See Figure 3.
4. The deviation from a best fit straight line (BFSL) fitted to the output measured over the compensated temperature range. For errors beyond the compensated temperature range, See Figure 2.
5. Between case and sensing element.
6. 2X or 400psi, whichever is less. The maximum pressure that can be applied to a transducer without changing the transducer's performance or accuracy.
7. 3X or 600psi, whichever is less. The maximum pressure that can be applied to a transducer without rupture of either the sensing element or transducer.
8. Maximum temperature range for product with standard cable and connector is -20°C to +105°C.
9. Start time to data ready is the time to get valid data after POR (Power on Reset). The time to get subsequent valid data is then specified by the response time specification.
10. Sharp edge strongly recommended for welding applications. Optimum weld parameters will reduce the effect of weld heat on sensor performance. Devices with lower pressure ranges have greater susceptibility to heat generated during the weld process
11. Device marking:  
Each part shall be identified with model number, pressure range, type ('A' for absolute or 'g' for gage), Lot number, serial number, and data code.
12. Shipping/Packaging Requirements:  
each device will be shipped individually packaged in a plastic vial with anti-static foam. For devices without fittings, the stainless steel diaphragm is protected by a static dissipative cap.
13. Direct mechanical contact with Diaphragm is prohibited. Diaphragm surface must remain free of defects (scratches, punctures, dents, fingerprints, etc) for device to operate properly. Caution is advised when handling parts with exposed diaphragms. Use protective cap whenever devices are not in use

## DIMENSIONS



| PAD/CNDTR | FUNCTION |
|-----------|----------|
| 1         | VDD      |
| 2         | GND      |
| 3         | SCL/SCLK |
| 4         | SDA/MISO |
| 5         | INT/SS   |



NOTE: WELD PREP SHOWN IS FOR RESISTANCE WELD. ACTUAL GEOMETRY VARIES PER CUSTOMER REQUIREMENTS.

TABLE 1: FITTING DIMENSIONS

| TABLE 1: FITTING DIMENSIONS |             |           |               |
|-----------------------------|-------------|-----------|---------------|
| FITTING TYPE                | "A" DIM     | "B" DIM   | "C" DIM       |
| 4                           | 1/4-18 NPT  | .93[23.6] | 5/8[15.9] HEX |
| 5                           | 1/4-19 BSP  | .96[24.4] | 3/4[19.0] HEX |
| 8                           | 1/8-27 NPT  | .80[20.3] | 5/8[15.9] HEX |
| 0                           | w/o FITTING |           |               |
| ALL DIMS ARE FOR REFERENCE  |             |           |               |

## BLOCK DIAGRAM

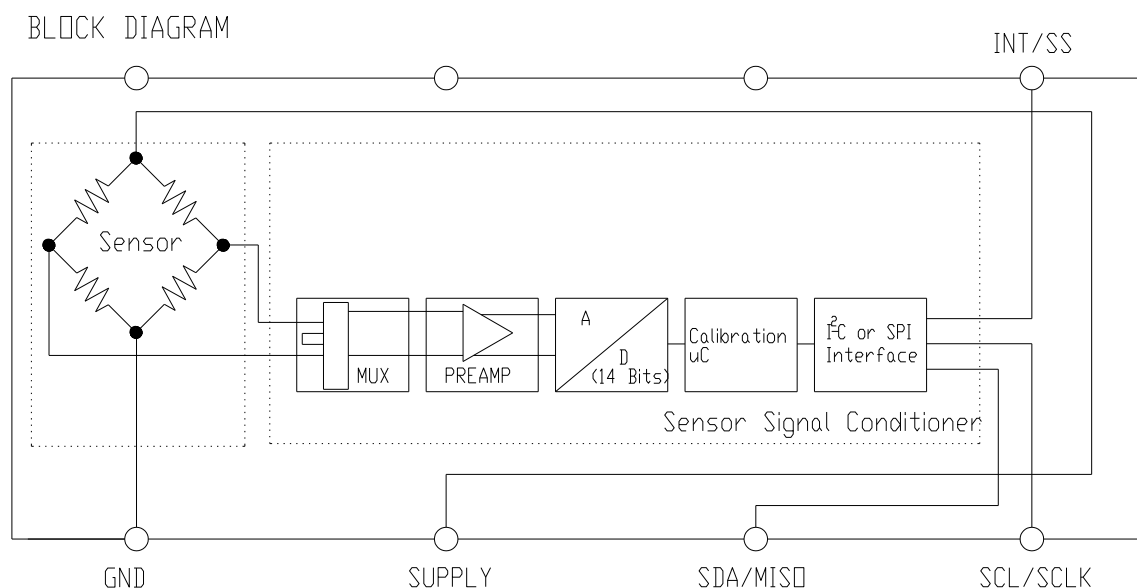


Fig 1

### I2C INTERFACE PARAMETERS

| PARAMETERS                                      | SYMBOL             | MIN | TYP | MAX | UNITS |
|-------------------------------------------------|--------------------|-----|-----|-----|-------|
| SCLK CLOCK FREQUENCY                            | F <sub>SCL</sub>   | 100 |     | 400 | KHz   |
| START CONDITION HOLD TIME RELATIVE TO SCL EDGE  | t <sub>HDSTA</sub> | 0.1 |     |     | μs    |
| MINIMUM SCL CLOCK LOW WIDTH @1                  | t <sub>LOW</sub>   | 0.6 |     |     | μs    |
| MINIMUM SCL CLOCK HIGH WIDTH @1                 | t <sub>HIGH</sub>  | 0.6 |     |     | μs    |
| START CONDITION SETUP TIME RELATIVE TO SCL EDGE | t <sub>SUSTA</sub> | 0.1 |     |     | μs    |
| DATA HOLD TIME ON SDA RELATIVE TO SCL EDGE      | t <sub>HDDAT</sub> | 0   |     |     | μs    |
| DATA SETUP TIME ON SDA RELATIVE TO SCL EDGE     | t <sub>SUDAT</sub> | 0.1 |     |     | μs    |
| STOP CONDITION SETUP TIME ON SCL                | t <sub>SUSTO</sub> | 0.1 |     |     | μs    |
| BUS FREE TIME BETWEEN STOP AND START CONDITION  | t <sub>BUS</sub>   | 2   |     |     | μs    |

### SPI INTERFACE PARAMETERS

| PARAMETERS                                | SYMBOL            | MIN | TYP | MAX | UNITS |
|-------------------------------------------|-------------------|-----|-----|-----|-------|
| SCLK CLOCK FREQUENCY                      | F <sub>SCL</sub>  | 50  |     | 800 | KHz   |
| SS DROP TO FIRST CLOCK EDGE               | t <sub>HDSS</sub> | 2.5 |     |     | μs    |
| MINIMUM SCL CLOCK LOW WIDTH @1            | t <sub>LOW</sub>  | 0.6 |     |     | μs    |
| MINIMUM SCL CLOCK HIGH WIDTH @1           | t <sub>HIGH</sub> | 0.6 |     |     | μs    |
| CLOCK EDGE TO DATA TRANSITION             | t <sub>CLKD</sub> | 0   |     | 0.1 | μs    |
| RISE OF SS RELATIVE TO LAST CLOCK EDGE    | t <sub>SUSS</sub> | 0.1 |     |     | μs    |
| BUS FREE TIME BETWEEN RISE AND FALL OF SS | t <sub>BUS</sub>  | 2   |     |     | μs    |

@1 COMBINED LOW AND HIGH WIDTHS MUST EQUAL OR EXCEED MINIMUM SCL PERIOD.

## TEMPERATURE ACCURACY / TOTAL ERROR BAND

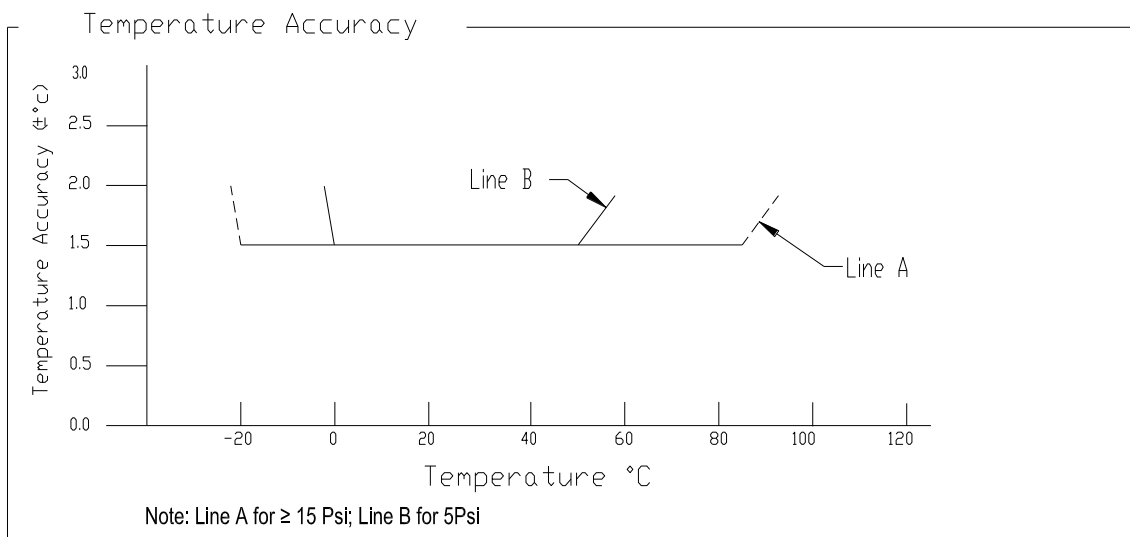


Fig 2

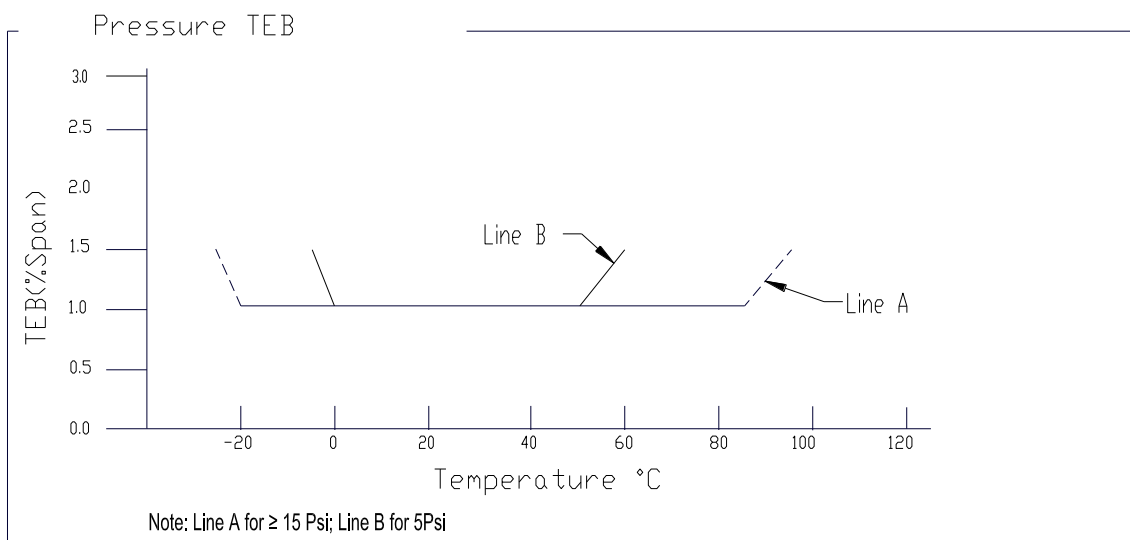


Fig 3

## PRESSURE TRANSFER FUNCTIONS

Pressure Transfer Functions

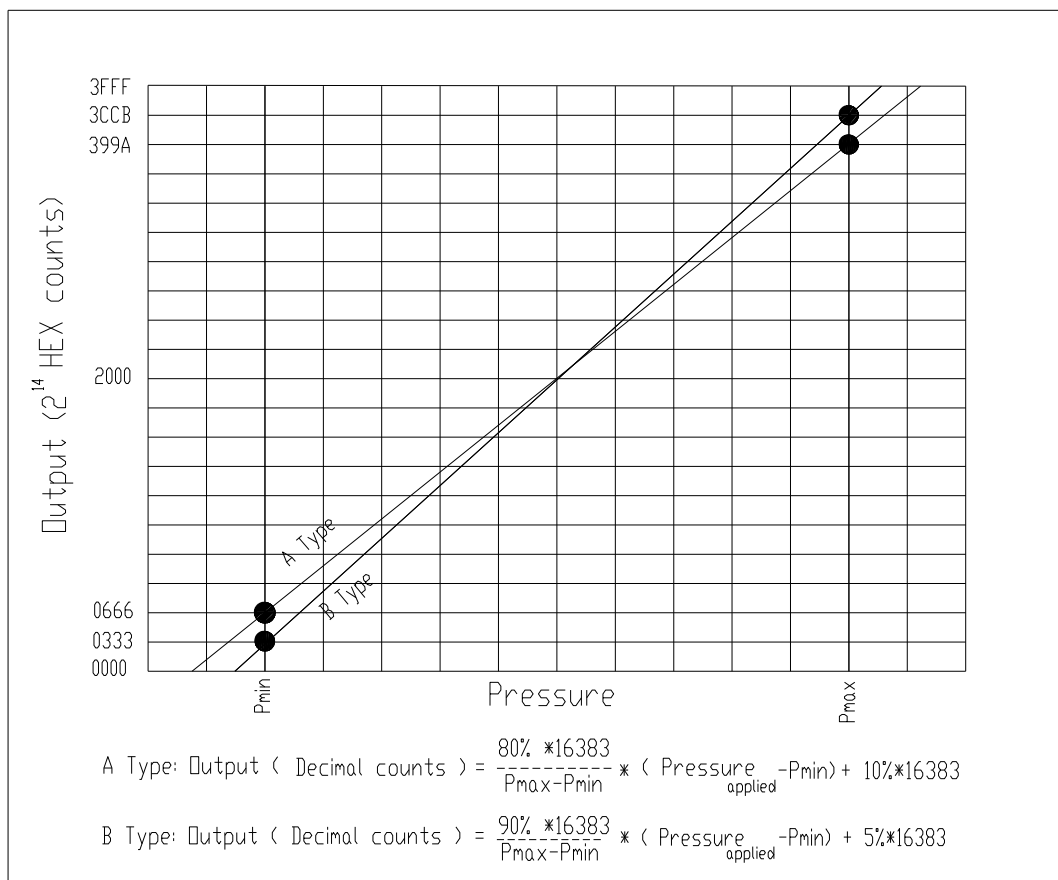


Fig 4

Sensor Output at Significant Percentages

| % Output | Digital Counts (decimal) | Digital Counts (hex) |
|----------|--------------------------|----------------------|
| 0        | 0                        | 0 X 0000             |
| 5        | 819                      | 0 X 0333             |
| 10       | 1638                     | 0 X 0666             |
| 50       | 8192                     | 0 X 2000             |
| 90       | 14746                    | 0 X 399A             |
| 95       | 15563                    | 0 X 3CCB             |
| 100      | 16383                    | 0 X 3FFF             |

## TEMPERATURE TRANSFER FUNCTIONS

### Temperature Transfer Functions

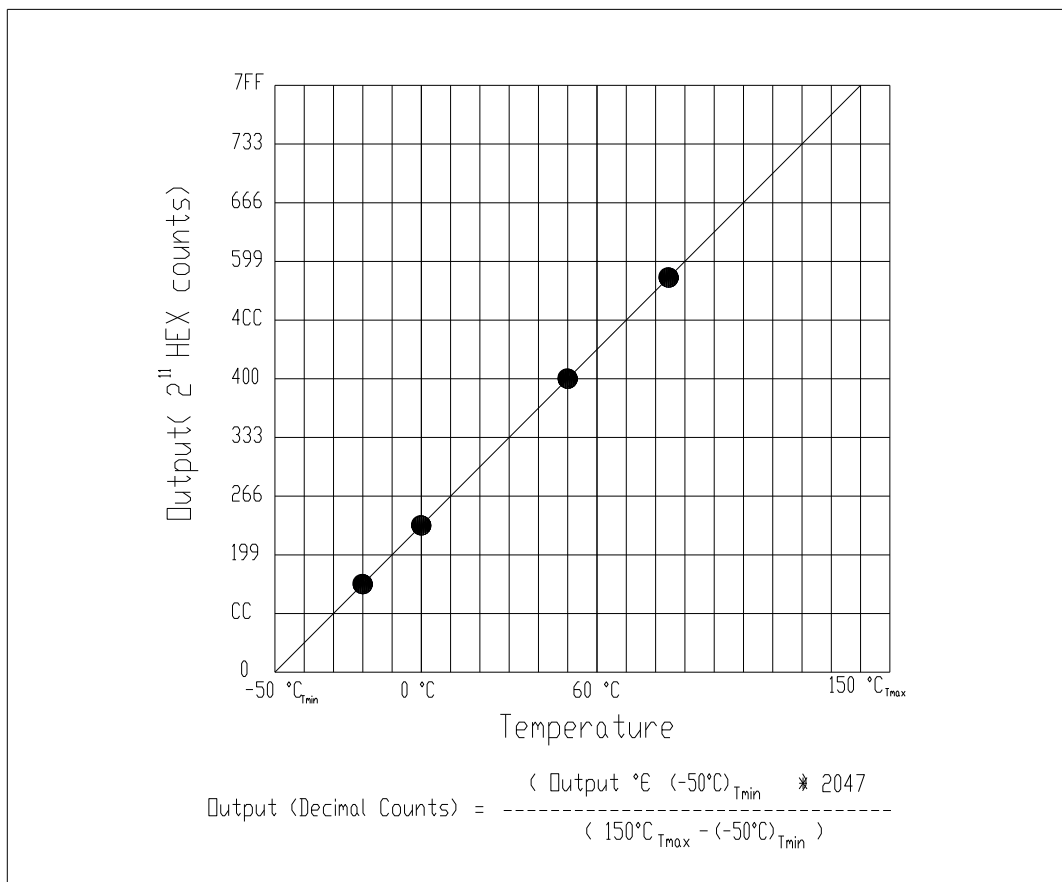


Fig 5

### Temperature Output vs Counts

| Output °C | Digital Counts (decimal) | Digital Counts (hex) |
|-----------|--------------------------|----------------------|
| -50       | 0                        | 0 X 0000             |
| -20       | 307                      | 0 X 0133             |
| 0         | 512                      | 0 X 0200             |
| 25        | 767                      | 0 X 02FF             |
| 50        | 1024                     | 0 X 0400             |
| 85        | 1381                     | 0 X 0565             |
| 150       | 2047                     | 0 X 07FF             |

## ORDERING INFORMATION

85BSD – 030P A 0 – 3 B J P (LT)

| Pressure Range |      |                   |
|----------------|------|-------------------|
| psi            | bar  | Reference         |
| 005P           | .35B | Gage Only         |
| 015P           | 001B | Absolute and Gage |
| 030P           | 002B |                   |
| 050P           | 005B |                   |
| 100P           | 007B |                   |
| 150P           | 010B |                   |
| 200P           | 014B |                   |
| 300P           | 020B |                   |

Intermediate Pressure Ranges Available

| Pressure Type |          |
|---------------|----------|
| G             | Gage     |
| A             | Absolute |

| Fitting Type |             |            |                |
|--------------|-------------|------------|----------------|
| Code         | 'A' Dim     | 'B' Dim    | 'C' Dim        |
| 4            | 1/4-18 NPT  | .93 [23.6] | 5/8 [15.9] Hex |
| 5            | 1/4-19 BSP  | .96 [24.4] | 3/4 [19.0] Hex |
| 8            | 1/8-27 NPT  | .80 [20.3] | 5/8 [15.9] Hex |
| 0            | w/o Fitting |            |                |

All Dims are for Reference

| Supply Voltage |                    |
|----------------|--------------------|
| 3              | 3.3V <sub>DC</sub> |
| 5              | 5.0V <sub>DC</sub> |

| Power Mode/Vent Tube |                    |
|----------------------|--------------------|
| LT                   | Low Power w/ Tube  |
| L                    | Low Power w/o Tube |
| T                    | Standard w/ Tube   |
| [Blank]              | Standard, No Tube  |

| Connection |                    |
|------------|--------------------|
| P          | Pad                |
| R          | Ribbon cable       |
| C          | Cable w/ Connector |

| Interface |                               |
|-----------|-------------------------------|
| I         | I <sup>2</sup> C(Addr. 0x28H) |
| J         | I <sup>2</sup> C(Addr. 0x36H) |
| K         | I <sup>2</sup> C(Addr. 0x46H) |
| S         | SPI                           |

| Output |          |
|--------|----------|
| A      | 10 – 90% |
| B      | 5 – 95%  |

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