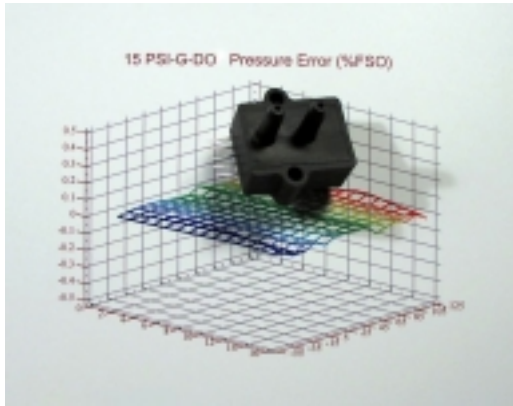


# DIGITAL OUTPUT PRESSURE SENSORS

Enhanced Digital Output Sensors MILITARY GRADE



## Features

- 5" H<sub>2</sub>O to 100psi Pressure Ranges
- All Combined Errors Over Temperature Less Than 0.1%, Typical
- Wide -40 to 125°C Compensated Temperature Range
- Electrically Compatible to All Sensors GA142 Series
- Enhanced Dual Serial Interface Mode

## Applications

- Medical Instrumentation
- Environmental Controls
- HVAC
- Meteorology

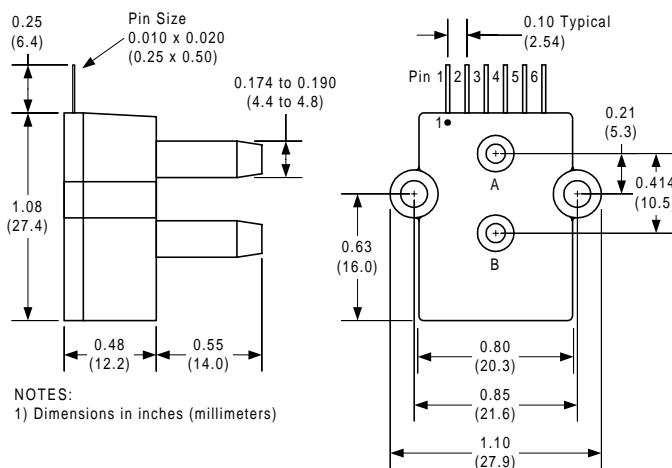
## General Description

The Digital Output pressure sensors are based upon a proprietary surface mapping technology to produce a fully digital output that virtually eliminates all repeatable errors over temperature and pressure. This series provides a 12 bit digital serial output (14 bit in High Resolution Mode) with superior offset, span and linearity characteristics. The output is SPI and MICROWIRE/PLUS<sup>®</sup> compatible as well as fully compatible with the All Sensors GA142 Series sensors.

In addition to synchronous communications, the Digital Output pressure sensors incorporates a bi-directional, TTL level, asynchronous serial interfaces mode (hardware selectable 9,600 or 19,200 baud). This mode includes a command set that allows the host to interrogate the sensor for model information, pressure range, serial number, pressure units and conversion factor. The command set also allows the host to select a high resolution output mode, make minor adjustments to offset and has an addressable feature that allows multiple sensors to be tied to the same interface buss.

This series is intended for use with non-corrosive, non-ionic working fluids such as air, dry gases and the like. All signals are 5V TTL/CMOS compatible.

## Physical Dimensions



## Pin Descriptions

| Pin | Label      | Description   |
|-----|------------|---|
| 1   | Vcc        | +5V power supply input  |
| 2   | Data/SI    | Data output for synchronous mode. Serial in for asynchronous mode.  |
| 3   | Clock/SO   | Clock output for synchronous mode. Serial out for asynchronous mode.  |
| 4   | Ready/Mode | Ready output for synchronous mode. Selects asynchronous mode when held low during reset.                          |
| 5   | Convert/BR | Convert input for synchronous mode. Selects one of two baud rates for asynchronous mode (low=9,600, high=19,200). |
| 6   | Ground     | Ground for power and signals  |



## Absolute Maximum Ratings

|  |                  |
|--|------------------|
| Supply Voltage (Vcc)                   | 7Vdc             |
| Voltage on Any Pin with Respect to Gnd | -0.6 to Vcc+0.6V |
| Common-mode pressure                   | 50 psig          |
| Lead Temperature (soldering 2-4 sec.)  | 250°C            |

## Environmental Specifications

|                         |                                 |
|-------------------------|---------------------------------|
| Operating Voltage       | +4.75Vdc to +5.25Vdc            |
| Compensated Temperature | -40° C to +125° C               |
| Operating Temperature   | -40 to +125° C                  |
| Storage Temperature     | -40 to 125° C                   |
| Humidity Limits         | 0 to 95% RH<br>(non condensing) |

## Standard Pressure Ranges

| Part Number      | Operating Pressure | Units | FSO <sup>(2)</sup> | Digital Span <sup>(4)</sup> | Proof Pressure | Burst Pressure |
|------------------|--------------------|-------|--------------------|-----------------------------|----------------|----------------|
| 5 INCH-D-DO-MIL  | -5 to 5            | inH2O | 5                  | 1                           | 200 inH2O      | 300 inH2O      |
| 10 INCH-D-DO-MIL | -10 to 10          | inH2O | 10                 | 1                           | 200 inH2O      | 300 inH2O      |
| 20 INCH-D-DO-MIL | -20 to 20          | inH2O | 20                 | 1                           | 200 inH2O      | 500 inH2O      |
| 30 INCH-D-DO-MIL | -30 to 30          | inH2O | 30                 | 1                           | 200 inH2O      | 800 inH2O      |
| 1 PSI-D-DO-MIL   | -1 to 1            | PSI   | 1                  | 1                           | 5 PSI          | 15 PSI         |
| 5 PSI-D-DO-MIL   | -5 to 5            | PSI   | 5                  | 1                           | 10 PSI         | 30 PSI         |
| 15 PSI-D-DO-MIL  | -15 to 15          | PSI   | 15                 | 1                           | 60 PSI         | 120 PSI        |
| 15 PSI-A-DO-MIL  | 0 to 15            | PSIA  | 15                 | 2                           | 60 PSI         | 120 PSI        |
| BARO-DO-MIL      | 600 to 1100        | mBar  | 1100               | 3                           | 60 PSI         | 120 PSI        |
| 30 PSI-G-DO-MIL  | 0 to 30            | PSI   | 30                 | 2                           | 90 PSI         | 150 PSI        |
| 30 PSI-A-DO-MIL  | 0 to 30            | PSIA  | 30                 | 2                           | 90 PSI         | 150 PSI        |
| 100 PSI-G-DO-MIL | 0 to 100           | PSI   | 100                | 2                           | 200 PSI        | 250 PSI        |
| 100 PSI-A-DO-MIL | 0 to 100           | PSIA  | 100                | 2                           | 200 PSI        | 250 PSI        |

## General Performance Characteristics (All Models)

| Parameter <sup>(1)</sup> | Minimum | Nominal | Maximum | Units |
|--------------------------|---------|---------|---------|-------|
| Resolution               | 12      | --      | --      | Bit   |
| Conversion Speed         | --      | 8       | 16      | mS    |
| Supply Current           | --      | 8       | 12      | mA    |

## Performance Characteristics for 5 INCH-D-DO

| Parameter <sup>(1)</sup>            | Minimum | Nominal | Maximum | Units |
|-------------------------------------|---------|---------|---------|-------|
| Overall Accuracy <sup>(5)</sup>     | --      | 0.5     | 1.0     | %FSO  |
| Long Term Drift (one year)          | --      | --      | 0.5     | %FSO  |
| Offset Position Sensitivity (1g)    | --      | --      | 0.05    | %FSO  |
| Offset Warm-up Shift <sup>(3)</sup> | --      | --      | 0.25    | %FSO  |

## Performance Characteristics for 10 INCH-D-DO, 20 INCH-D-DO and 30 INCH-D-DO

| Parameter <sup>(1)</sup>            | Minimum | Nominal | Maximum | Units |
|-------------------------------------|---------|---------|---------|-------|
| Overall Accuracy <sup>(5)</sup>     | --      | 0.5     | 1.0     | %FSO  |
| Long Term Drift (one year)          | --      | --      | 0.5     | %FSO  |
| Offset Position Sensitivity (1g)    | --      | --      | 0.03    | %FSO  |
| Offset Warm-up Shift <sup>(3)</sup> | --      | --      | 0.25    | %FSO  |

## Performance Characteristics for 10 INCH-D-DO, 20 INCH-D-DO and 30 INCH-D-DO

| Parameter <sup>(1)</sup>            | Minimum | Nominal | Maximum | Units |
|-------------------------------------|---------|---------|---------|-------|
| Overall Accuracy <sup>(5)</sup>     | --      | 0.5     | 1.0     | %FSO  |
| Long Term Drift (one year)          | --      | --      | 0.5     | %FSO  |
| Offset Position Sensitivity (1g)    | --      | --      | 0.03    | %FSO  |
| Offset Warm-up Shift <sup>(3)</sup> | --      | --      | 0.25    | %FSO  |

## Performance Characteristics for BARO-DO

| Parameter <sup>(1)</sup>        | Minimum | Nominal | Maximum | Units |
|---------------------------------|---------|---------|---------|-------|
| Overall Accuracy <sup>(5)</sup> | --      | 1.0     | 2.5     | mBar  |
| Long Term Drift (one year)      | --      | --      | 2.0     | mBar  |

## Performance Characteristics for 1 PSI-D-DO through 100 PSI-A-DO (except BARO-DO)

| Parameter <sup>(1)</sup>        | Minimum | Nominal | Maximum | Units |
|---------------------------------|---------|---------|---------|-------|
| Overall Accuracy <sup>(5)</sup> | --      | 0.25    | 0.5     | %FSO  |
| Long Term Drift (one year)      | --      | --      | 0.25    | %FSO  |

### Specification Notes

- NOTE 1: UNLESS OTHERWISE SPECIFIED, ALL PARAMETERS ARE MEASURED AT 5.0 VOLT SUPPLY, POSITIVE PRESSURE APPLIED TO PORT B.
- NOTE 2: THE DIGITAL OUTPUT IS A 16 BIT SIGNED BINARY OUTPUT IN A TWO'S COMPLEMENT FORMAT. THE APPLIED PRESSURE IS COMPUTED USING THE PRESSURE CONVERSION TABLE (BELOW). THE MODE COLUMN IDENTIFIES THE RESOLUTION OPERATING MODE OF THE DEVICE (A = STANDARD RESOLUTION, B = HIGH RESOLUTION). FSO AND UNITS ARE SHOWN FOR EACH MODEL.
- NOTE 3: SHIFT IS WITHIN THE FIRST HOUR OF EXCITATION APPLIED TO THE DEVICE.
- NOTE 4: DIGITAL SPAN IS DEPENDENT ON THE RESOLUTION OPERATING MODE. REFER TO THE DIGITAL SPAN TABLE (BELOW) TO IDENTIFY THE DIGITAL SPAN OF THE SPECIFIC MODEL. IN THE EVENT OF AN OVER-PRESSURE OR UNDER-PRESSURE CONDITION, THE DIGITAL OUTPUT WILL ONE COUNT HIGHER OR ONE COUNT LOWER (RESPECTIVELY) TO THE LISTED DIGITAL SPAN TO INDICATE THE CONDITION.
- NOTE 5: OVERALL ACCURACY INCLUDES THE COMBINED EFFECTS OF OFFSET AND SPAN SHIFTS OVER TEMPERATURE, LINEARITY, HYSTERESIS, AND OFFSET AND SPAN CALIBRATION.

Digital Span Table

| Span | Mode S (Standard) | Mode H (High Res) |
|------|-------------------|-------------------|
| 1    | -10,399 to 10,399 | -32,767 to 32,766 |
| 2    | -399 to 10,399    | -999 to 32,766    |
| 3    | 5,054 to 10,399   | 17,501 to 32,766  |

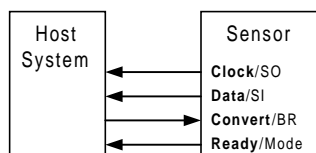
Pressure Conversion Table

| Mode | Pressure Output Equation   |
|------|--|
| S    | $P_{Out} = Digital\_Out \cdot \left( \frac{FSO \cdot Units}{10,000} \right)$ |
| H    | $P_{Out} = Digital\_Out \cdot \left( \frac{FSO \cdot Units}{32,767} \right)$ |

## Typical Configurations

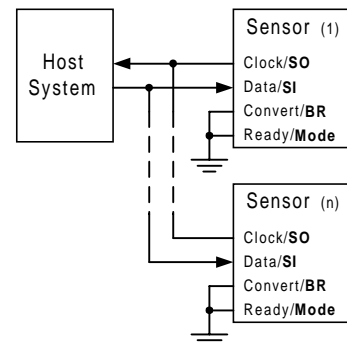
### Synchronous Communications

Typical synchronous communications configuration (compatible with All Sensors GA142 Series Digital Output Sensors).



### Asynchronous Communications

Typical asynchronous communications configuration. The Mode pin is interrogated at power up and if tied low, will cause the sensor to enter asynchronous communications mode. This mode supports multiple sensors by addressable commands. The Convert/BR pin then serves to select one of two available baud rates.



## Asynchronous Command Summary <sup>(1,2)</sup>

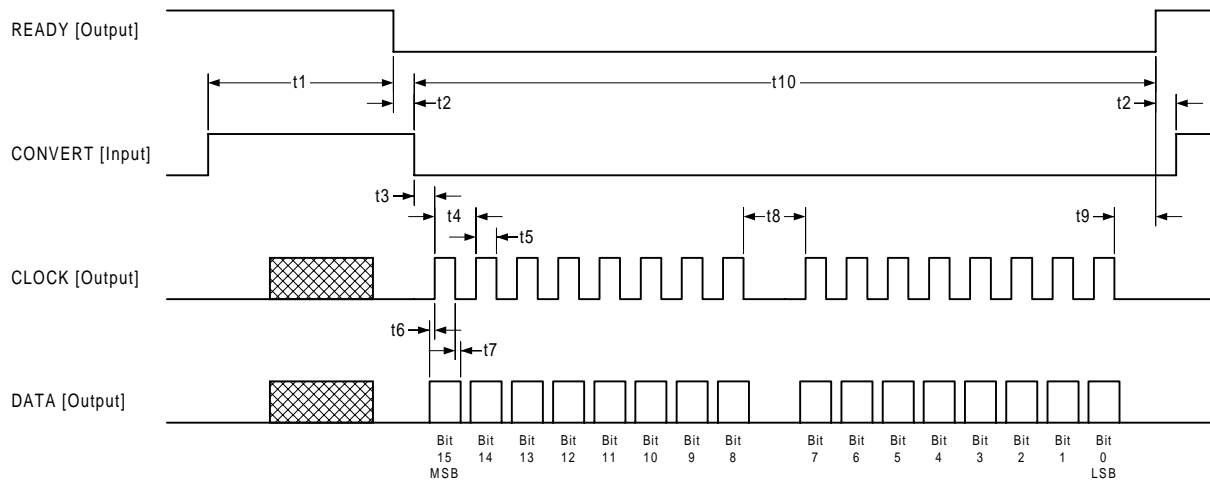
| Command     | Description  | Response                  |
|-------------|--|---------------------------|
| RD          | Read Mode Setting  | RD=<Mode>                 |
| RM          | Read Model Information   | RM=<Model String>         |
| RO          | Read User Offset Setting   | RO=<hhhh>                 |
| RP          | Read Pressure  | RP=<hhhh>                 |
| RR          | Read Device Pressure Range   | RR=<Range String>         |
| RS          | Read Serial Number   | RS=<Serial Number String> |
| WD<Mode>    | Write Mode Setting ("S" = Standard, "H" = High Resolution)               | WD=<Mode>                 |
| WO<Offset>  | Write User Offset Setting  | WO=<hhhh>                 |
| U<S/N><Cmd> | Select Unique Part for following command (for multidrop configurations). | U<S/N><Cmd>               |

### Asynchronous Command Notes

NOTE 1: ALL COMMANDS AND RESPONSES ARE IN ASCII CHARACTER FORMAT AND ARE TERMINATED BY A CARRIAGE RETURN (CARRIAGE RETURNS ARE NOT SHOWN IN COMMAND AND RESPONSE TABLE). EXAMPLE: THE READ PRESSURE COMMAND (REPRESENTED BY: RP<CR>) IS GIVEN BY THE FOLLOWING THREE BYTE SEQUENCE: 0x52 0x50 0x0D

NOTE 2: <HHHH> IS A FOUR BYTE ASCII STRING REPRESENTING A 16-BIT SIGNED VALUE. EXAMPLE: P=2B7D REPRESENTS THE RESPONSE OF AN RP COMMAND WITH THE PRESSURE OUTPUT OF 0x2B7D (11,133 DECIMAL) VALUE.

## Synchronous Timing Diagram (Note: Asynchronous mode timing is per RS-232)



| Ref | Parameter        | Min | Typ | Max | Units |
|-----|------------------|-----|-----|-----|-------|
| t1  | Conversion Time  | --  | 8   | 16  | msec  |
| t2  | Ready to Convert | 0   | --  | --  | usec  |
| t3  | Convert to Clock | 24  | 32  | 39  | usec  |
| t4  | Clock Period     | --  | 16  | --  | usec  |
| t5  | Clock High Time  | --  | 8   | --  | usec  |

| Ref | Parameter         | Min | Typ | Max | Units |
|-----|-------------------|-----|-----|-----|-------|
| t6  | Data Setup Time   | --  | 3   | --  | usec  |
| t7  | Data Hold Time    | --  | 3   | --  | usec  |
| t8  | Interbyte Delay   | --  | 57  | --  | usec  |
| t9  | Clock to Ready    | --  | 14  | --  | usec  |
| t10 | Data Transmission | --  | 335 | --  | usec  |

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