

# BAROMETRIC PRESSURE SENSOR OPERATION MANUAL P/N 102663



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## **Safety Notice**

The contents of this manual have been checked against the hardware and software described herein. Since deviations cannot be prevented entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections are included in subsequent editions.

Faultless and safe operation of the product presupposes proper transportation, storage, and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation. The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

## **Electrical & Safety Conformity**

The manufacturer certifies that this product operates in compliance with the following standards and regulations:

FDA/CDRH This product is tested and complies with 21 CFR, Subchapter J, of the Health and Safety Act of 1968

US 21 CFR 1040.10

## **Warranty**

All instruments are warranted against defects in parts or workmanship for a period of two (2) years from the date of shipment. Should any instrument or part prove to be defective within the warranty period, upon written notice and return of the unit (freight prepaid), Climatronics Corporation will, at its option, repair or replace the defective unit, and return it, transportation prepaid via UPS.

Equipment abused, modified, or altered may cause cancellation of this warranty.

The above warranty applies only to items manufactured by Climatronics Corporation. Items not manufactured by Climatronics Corporation are warranted only to the extent and in the manner warranted by the manufacturer of such items. Should emergency warranty repair be required at a customer's facility, Climatronics will provide such repairs and charge only the portal-to-portal Field Service rates and actual expenses in accordance with our published rates then in effect. Expendable supplies and wear items, such as bearings and lightning-related damages, are not covered under this warranty.

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## 1.0 Safety

### 1.1 Safety

This manual may include a **CAUTION** and a **WARNING** indication. Familiarize yourself with the following definitions for the meanings of these indicators.

A **CAUTION** indicates a hazard and calls attention to a procedure that if not correctly followed could result in damage to the instrument. Do not proceed beyond a caution indicator without understanding the hazard.

A **WARNING** indicates a hazard to you and calls attention to a procedure that if not correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

## **2.0 Introduction & Overview – Barometric Pressure Sensor**

### **2.1 Overview**

The 102663 Barometric Pressure Sensor is designed to measure ambient atmospheric pressure and provide serial digital outputs and analog outputs all from the same sensor module. Pressure is sensed using a board mounted digital pressure sensor. An on board CPU scales pressure measurement and performs communications.

The 102663 is simple to set up and use. The analog output voltage and pressure range limits are set with DIP switches. The DIP switches allow quick configuration without requiring a laptop or data-logger for communication.

Additional parameters may be configured with a terminal connection (see section 10). The terminal connection accommodates standard RS-232 and RS-485. The SDI-12 interface parameters may be configured using an SDI-12 master in the transparent mode. Consult the manual for your particular datalogger for additional information.

## 2.2 Specifications

### Operational

Range:	600-1100 mbar (17.72-32.48 in Hg)
Resolution:	0.1 mbar (.003 Hg)
Temp. Operating Range:	-40 to +55°C
Temp. Compensated Range:	-40 to +55°C
Accuracy:	±0.35 mbar @ +25°C ±0.75 mbar @ 0 to +55°C ±1.5 mbar @ -40°C
Long Term Stability:	±1 mbar in 12 months

### Analog Output

0 –1, 0 – 2, 0-2.5, or 0-5 VDC  
(Analog output automatically adjusts to zero to full scale for range selected.  
Default output = 0-5 VDC, 800-1100 mbar)

### Digital Outputs

RS-232  
RS-485  
SDI-12 (Default address = 0)

### Communications Protocol

Terminal mode and for RS-232 and RS485  
SDI-12

### Serial Settings

Baud options = 1200, 2400, 4800, 9600, 19200;  
8 data bits, no parity, and 1 stop bit.  
Default baud rate = 19200

### Power

10-36 VDC, 10 ma @ 12VDC

### Connections

Screw terminals on circuit board

### Size

Polycarbonate Enclosure  
4.72 x 3.14 x 2.16 inches  
(120 x 80 x 55 mm)

\*Analog output range set with DIP switches, lower range settings 600, 700, 800, 900 mbar, upper range settings 800, 900, 1000, 1100  
(Invalid DIP switch settings produce 600-1100 mbar range. Default range = 800-1100 mbar.)

### 3.0 Installation

The sensor is designed for indoor or outdoor use.  
Refer to Figures 3.1 and 3.2 for mounting dimensions.

#### 3.1 Mounting for Outdoor Use

When designated for outdoor use, the unit is supplied with a solar shield and U-bolts. The sensor is provided attached to the solar shield. Install the solar shield with the U-bolts provided on any vertical pipe up to 2" IPS. For mounting on a flat surface, remove U-bolts. Refer to Figure 3.1 for mounting dimensions. Install the sensor to face a northerly direction so that the solar shield protects the sensor enclosure from direct sunlight.

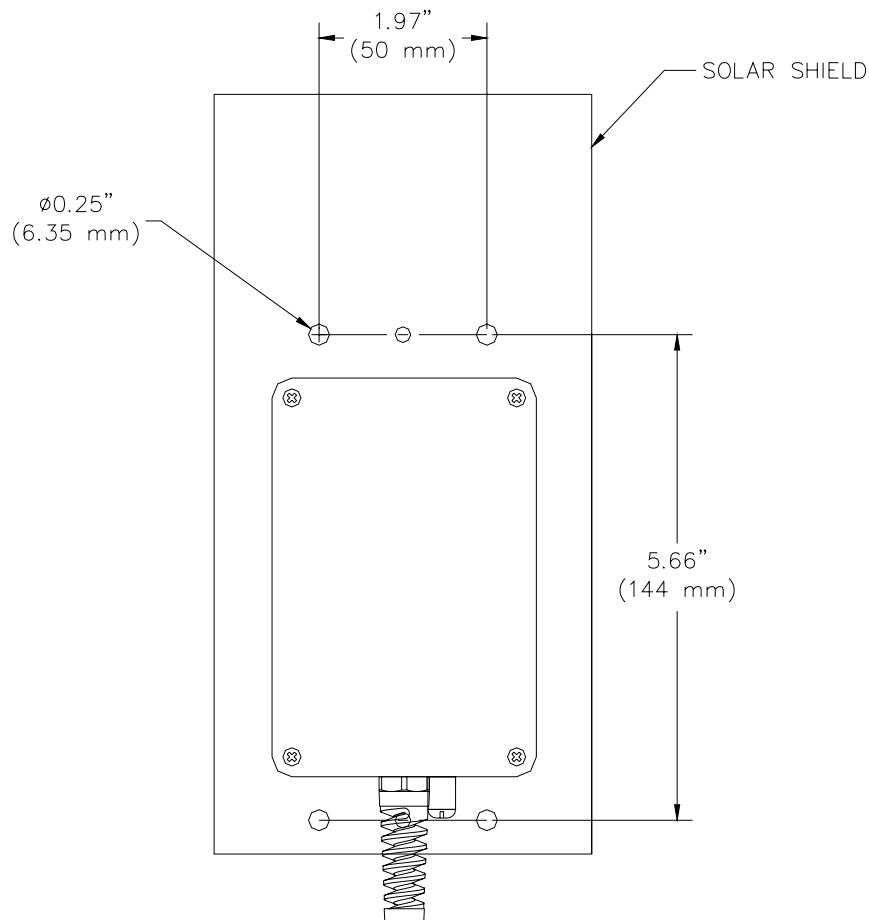


Figure 3.1



### 3.2 Mounting for Indoor Use

For indoor mounting to a flat surface without the solar shield, refer to Figure 3.2 for mounting dimensions. Please note, the cover must be removed to access the mounting holes when mounting the pressure sensor in this manner. It is important to replace the cover after mounting. Pressure sensor module is light sensitive and will not operate properly if cover is removed.

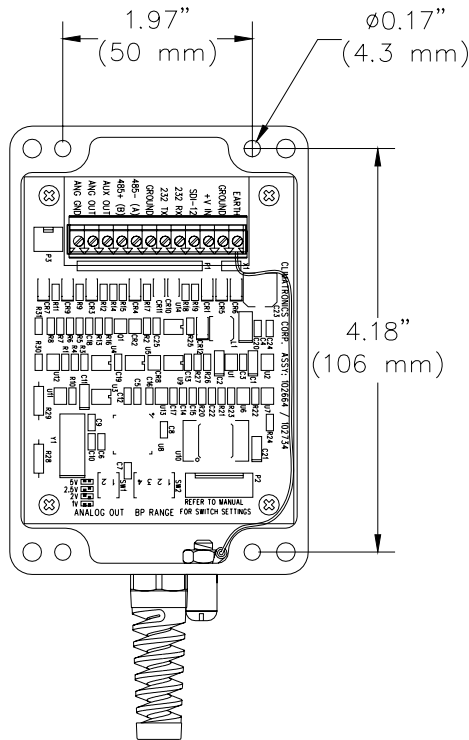


Figure 3.2

### 4.0 Input/Output Connections

See Appendix C for wiring details.

Figure C.1, 102663-1 and 102663-2: Analog, SDI-12, and RS232 outputs (Standard wiring). Alternate RS485 wiring shown by dashed lines.

Figure C.2, 102663-3: Optional Analog output.

Caution: All outputs, Analog, SDI-12, RS232, and RS485 have voltage on them. If any live outputs are not being used, these wires should be properly protected so as not to short to ground or any other wires.

**Note:** Be sure to replace cover after any wiring changes. Pressure sensor module is light sensitive and will not operate properly if cover is removed.

## 5.0 User Interface

### SW1-Analog Output Switch Settings

Range	SW1-1	SW1-2
0-1 V	On	On
0-2 V	On	Off
0-2.5 V	Off	On
0-5 V	Off	Off

### SW2 - Pressure Range Switch Settings

Lower Range	Upper Range	SW2-1	SW2-2	SW2-3	SW2-4
600	800	On	On	On	On
600	900	Off	On	On	On
600	1000	On	Off	On	On
600	1100	Off	Off	On	On
700	800	On	On	Off	On
700	900	Off	On	Off	On
700	1000	On	Off	Off	On
700	1100	Off	Off	Off	On
800	800	On	On	On	Off
800	900	Off	On	On	Off
800	1000	On	Off	On	Off
800	1100	Off	Off	On	Off
900	800	On	On	Off	Off
900	900	Off	On	Off	Off
900	1000	On	Off	Off	Off
900	1100	Off	Off	Off	Off

Combinations not shown in the chart above will result in the 600-1100mB range being selected.

**Note:** Be sure to replace cover after any dip switch changes. Pressure sensor module is light sensitive and will not operate properly if cover is removed.

## **6.0 Calibration**

Calibration is performed against a NIST traceable standard. The calibration coefficients are stored in non-volatile memory at the factory. No user calibration is available. The sensor must be returned to Climatronics if periodic calibration is desired.

## **7.0 Maintenance**

Periodic cleaning of the sintered filter on the bottom of the unit may be required in dusty conditions. Remove the filter from the bottom of the unit and clean with distilled water.

Return of the sensor to Climatronics for a yearly recalibration is recommended.

## **8.0 Control and Communication**

Operational parameters of the 102663 are set with board mounted DIP switches and by using one of the serial communications protocols. These protocols include; SDI-12 and simple two character terminal commands via RS-232 or RS-485.

Refer to Section 5.0 for dip switch settings, Appendix A for commands, and Appendix C for wiring.

## Appendix A

### Terminal Mode and SDI Commands

The terminal emulator supports using a VT-100 terminal. Sending three (3) carriage returns within two seconds starts the terminal service. Terminal mode begins by displaying the model, date code, serial number, and software revision: i.e. 102663-YY-XXXXX-XX.X

Note: Pressure measurements are suspended while the terminal service is active. SDI-12 polls will return the last pressure value measured before terminal service was entered.

Command	Description
<b>DR</b>	Display range switch setting for analog output. Command: DR<cr>
<b>HE</b>	Display the Help menu Command: HE<cr>  HE - This Help menu LB - Toggle Verbose mode, use with CR-10X LC - Last Calibration information PU - Sets Pressure Units QU - Quit command mode and save any changes SB - Baud rate setting ST - Serial Trigger (RS-485 Only) VN - Version Number
<b>LB</b>	Verbose Control of RS-232/485 Parameter Labels for Dataloggers Command: LBx<cr> Where x=1 to enable labels (default) Where x=0 to suppress labels
<b>LC</b>	Display the last calibration information table. Command: LC<cr> Returns the serial number and date of last calibration.
<b>OI</b>	Select Output Interval (sec) 1, 5, 10, 15, 30, 60 Command: OIx<cr> Where x=seconds (0=serial trigger, 1 sec default)
<b>PU</b>	Pressure Units Sets the units for Pressure Command: PUx<cr> Where x is: 0 - Millibars (default) 1 - Hectopascals 2 - Inches of Mercury 3 - Millimeters of Mercury 4 - Kilopascals

<b>Command</b>	<b>Description</b>
<b>QU</b>	Quit Exit the command or terminal mode and save all changes. Command: QU<cr> Not supported by SDI-12
<b>SB</b>	Serial Baud Rate Command: SBx<cr> Where x is: 1 - 1200 Baud 2 - 2400 Baud 3 - 4800 Baud 4 - 9600 Baud 5 - 19200 Baud (default)
<b>ST</b>	Serial Trigger (RS-485 Only) Set the string used in Rs-485 mode to serve as a trigger for the unit's send data command. Command: STx<cr> Where 'x' is the serial trigger string. The 'x' character can be anything from one to six characters, but cannot be three "!" in a row.
<b>VN</b>	Version Number Returns the firmware version number Command: VN<cr>

## SDI-12 Commands

NAME	SDI-12 COMMAND	SENSOR RESPONSE
Address Query	?!	a<CR><LF> Where a = address
Acknowledge Active	a!	a<CR><LF> Where a = address
Send Identification	aI!	a13Climo 102663 1.0 0Axxxxx<CR><LF> Where a=address and xxxxx = S/N
Change Address	aAb!	b<CR><LF> Where b = new address
Start Measurement	aM!	a0001<CR><LF> Where a = address
Start Measurement with CRC	aMC!	a0001<CR><LF> Where a = address
Send Data.	aD0!	a+ xxxx.x <CR><LF> Where a = address and xxxx.x = data
Start Concurrent Measurement	aC!	a00001<CR><LF> Where a = address
Start Concurrent Measurement with CRC	aCC!	a00001<CR><LF> Where a = address
Continuous Measurements	aR0!	a+xxxx.x<CR><LF> Where a = address and xxxx.x = data
Continuous Measurements with CRC	aRC0!	a+xxxx.x{crc}<CR><LF> Where a = address, xxxx.x = data and {crc} = CRC
* Display Last Calibration	aXLC!	aXLCyymmdd<CR><LF> Where yymmdd is date of last calibration
* Set Pressure Units	aXPUf!	aXPUf<CR><LF> Where f is: 0 for Millibars (default), or 1 for Hectopascals, or 2 for Inches of Mercury, or 3 for Millimeters of Mercury, or 4 for Kilopascals
* Display Version Number.	aXVN!	aXVNxx.x<CR><LF> Where a = address and xx.x = firmware version

\* Extended SDI-12 commands not available with all dataloggers.

## **Appendix B**

### **Theory of Operation**

The 102663 Barometric Pressure Sensor utilizes a piezoresistive pressure sensor module. This module contains an analog to digital converter, a temperature sensor, and non-volatile memory for storage of calibration coefficients. The pressure sensor module communicates with a highly integrated, mixed-signal microcontroller via a 3-wire serial peripheral interface (SPI). The pressure sensor is light sensitive and will not operate properly if exposed to light. The cover must be kept on during operation for accurate measurements.

The microcontroller contains two UARTS. One is connected to the RS-232 and RS-485 interfaces, while the second performs SDI-12 communications. The two serial ports function independently for the most part. The exception is the selection of pressure units which is common to both ports. It is possible to utilize the RS-232/485 port in interval or polled mode while an SDI-12 data recorder polls the sensor for data.

The microcontroller also contains a 12-bit digital to analog converter (DAC) for the sensor's analog output. The DAC is connected to a programmable gain amplifier stage. The gain of the output amplifier is set with dip switches (SW1). This allows the selection of 0-1, 0-2, 0-2.5, or 0-5 Volts for the analog output.

At startup, the microcontroller reads the calibration coefficients from the pressure sensor module and compares them to values stored in its own non-volatile memory during factory calibration. An error message is displayed on the RS-232/485 port if the values do not match to indicate that one of the non-volatile memory sources may be corrupt or the sensor module may be malfunctioning.

The microcontroller polls the pressure sensor module once per second for the barometric pressure and ambient temperature. The raw readings are temperature corrected by the microcontroller. Then, second and third order temperature corrections are applied to the pressure reading. Finally, an individual factory determined calibration coefficient is applied and the pressure value is stored for output.

The microcontroller reads the state of the pressure range dip switches (SW2) once per second to determine the scaling of the analog output range. The pressure value is checked for under-range and over-range conditions and sent to the DAC for output. An under-range condition will produce an output of zero volts, while an over-range condition will set the analog output to the full-scale voltage as determined by the setting of the output range dip switches (SW1). Please note that analog output accuracy and resolution will be optimized by selecting the narrowest pressure range that will be encountered at the location where the sensor will be used.

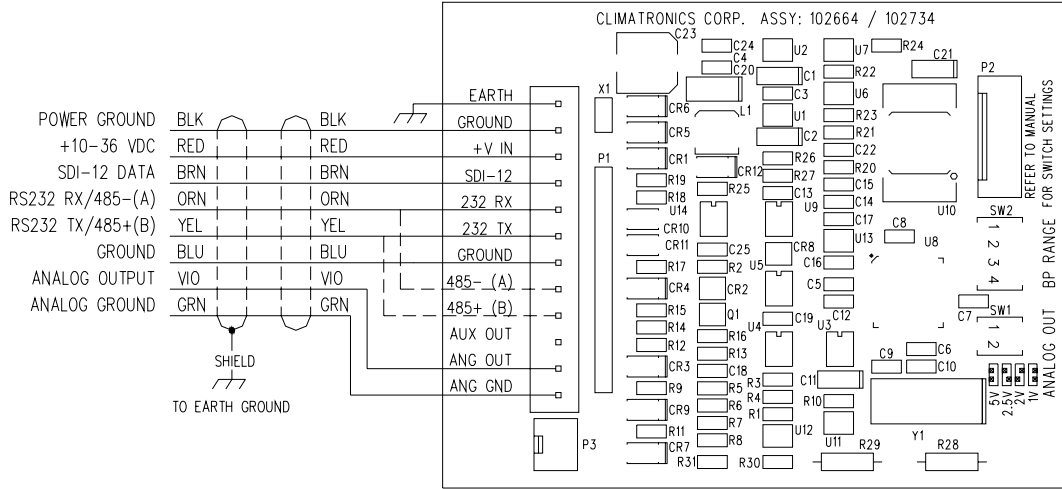
The setting of the pressure range dip switches does not affect the range of the serial output. The serial message may deviate to values outside of the range of 600 to 1100 millibars if the sensor is subjected to ambient pressures outside of this range. Pressure conditions in the range of 10 to 10,000 millibars will not harm the sensor, but the measurement accuracy is not guaranteed beyond the range of 600 to 1100 millibars.

All input and output lines are protected from static surge damage by Transzorbs and current limiting resistors.



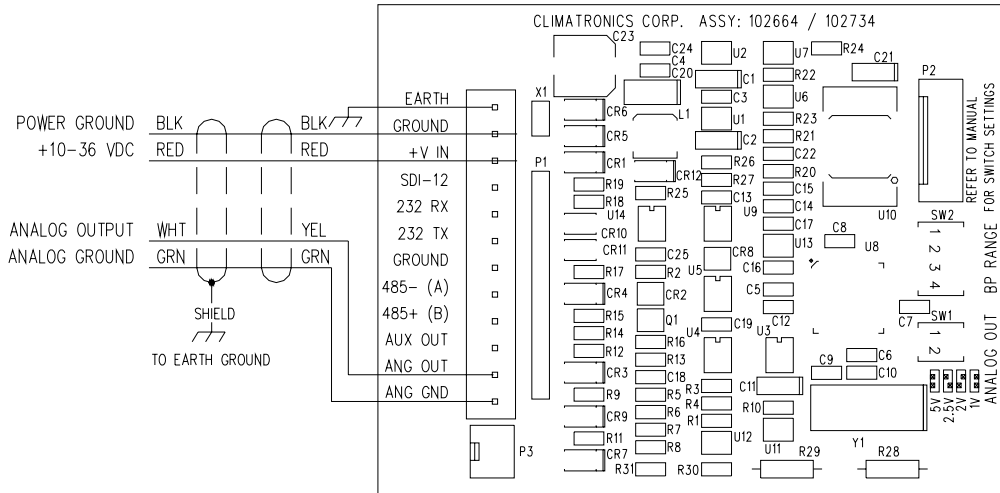
# Appendix C Wiring

## Standard Wiring



**Figure C.1**

## Optional Analog Wiring



**Figure C.2**

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Revision	Description	Date	Approved
D	See ECN 5659	4/20/07	D.A.
E	See ECN 5825	1/7/10	C.H.
F	See ECN 5841	3/9/10	C.H.