Micro Pressure Sensor

User's Manual

Document Version 1.2
April 2005

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1 – INTRODUCTION

The AML Oceanographic Micro Pressure Sensor is a single-parameter, self contained, intelligent oceanographic sensor. This manual describes the Micro Pressure Sensor instrument, covering the standard specifications, operation, use, communication, troubleshooting, and maintenance requirements. Please refer to your device specifications to confirm details of the configuration of your unit.

1.1 Warranty and Limitation of Liability

AML Oceanographic warrants the Micro Pressure Sensor against defects in workmanship and materials for a period of 1-Year. AML Oceanographic will repair or replace, at its option and at no charge, components that prove to be defective.

This warranty is the only warranty given by AML Oceanographic. No warranties implied by law, including but not limited to the implied warranties of merchantability and fitness for a particular purpose, shall apply. In no event will AML Oceanographic be liable for any direct, indirect, consequential or incidental damages resulting from any defects or failure of performance of any instrument supplied by AML Oceanographic.

This warranty does not apply if the instrument has been damaged, by accident or misuse, and is void if repairs or modifications are made by other than authorized personnel at our designated service facility. In the event such an instrument is returned for repairs, the customer will bear the cost for all repairs plus return freight charges. Any instrument returned to AML Oceanographic, whether within the warranty coverage period or not, and no defect is found upon inspection, the customer will be charged a two-hour diagnostic fee and the return freight charges.

Clients wishing to return an instrument for repair or inspection should contact the factory to receive instructions. Instruments returned to the factory without prior advice may be assessed a handling charge.

DISCLAIMER

AML Oceanographic reserves the right to make any changes in design, specifications, or operating functionality, at any time without incurring any obligation to modify previously delivered instruments.

Manuals are produced for information and reference purposes, and are subject to change without notice. If there is any clarification required as to the operation of our instruments, please do not hesitate to contact us to speak to a technical representative.

1.2 Instrument Specifications

Pressure Sensor:	Keller™ semiconductor strain gauge
Model:	PA-10
Accuracy:	±0.05 % full scale
Resolution:	0.1 dbar for ≥ 100 bar FS sensors, 0.01dbar for <100 bar FS sensors
Time constant:	10 ms
Output:	RS-232C autobaud communications
Baud rate:	2400 to 38400, 8 data bits, no parity, 1 stop bit.
Data type:	ASCII text
Sample Rate:	25 scans per second
Power:	Isolated External DC supply
Voltage range:	8-16 Volts DC
Nominal operating voltage:	12 Volts DC
Current consumption:	0.012 Amperes
Bulkhead Connector:	Impulse BH-8-FS
Mating cable connector:	Impulse PMCIL-8-MP
Pressure Housing Material:	Delrin: Acetron GP rated to 500m Stainless steel: T316 rated to 3500m Titanium: Grade 5 rated to 6000m
Dimensions:	33 mm (1.3") diameter by 122 mm (4.8") long
Weight:	490 grams in air
Environment:	Operating: -2 to 40°C (28 to 104°F) Storage: -40 to 60°C (-40 to 140°F)

1.3 System Description

The Micro Pressure Sensor is a single parameter, self-contained, intelligent pressure sensor.

The Micro Pressure Sensor features CMOS based microprocessor with 64 bytes of data memory for storing the instrument's calibration coefficients and an A/D converter with 1 part in 65000 counts resolution.

An on board thermistor mechanically attached to the pressure sensor allows the microprocessor to temperature compensate the pressure data to an accuracy of ±0.05% of full-scale pressure.

The Micro Pressure Sensor is designed for use with an IBM-PC compatible computer. The instrument's output is standard ASCII RS-232. The baud rate is automatically determined when the sensor receives an **<ENTER>** or **<RET>**. The data output may be configured to display either unprocessed integers, or computed engineering values. The sample rate is continuous at 25 scans per second. The instrument is powered externally by a power supply with a nominal voltage of 12 VDC.

1.4 About the User

This manual has been written with the following assumptions:

• The user has had some exposure to Windows™ (IBM-PC) compatible computers, and is moderately computer literate with a working knowledge of computer operation and terminology.

• The user is familiar with the operation and function of standard communications packages.

While it is possible to operate the Micro Pressure Sensor without these qualifications, some computer experience will greatly assist the user to pass through the learning curve more rapidly

2 GETTING STARTED

2.1 Inspecting the Instrument

An inspection of the Micro Pressure Sensor before each use will assist in spotting problems that could lead to inaccurate data or possible failure. Examine the outside of the shipping case for evidence of heavy impacts during transport. If signs of damage are visible continue with the inspection as follows and notify the carrier and the factory of any damage found. Examine the cable for cuts or wear and check the connector ends for visible damage.

2.2 Connecting the Micro Pressure Sensor to a Computer

The user communicates with the Micro Pressure Sensor via any IBM-PC or compatible computer or data collection device. An AML supplied data cable will link the two. Refer to the wiring diagram in *Appendix 'C'*. At one end of the cable is a DB25 or DB9 female connector that plugs into the computer's serial port and at the other end is a 8 pin plug that is inserted into the communications port of the Micro Pressure Sensor. When this connection has been made and 12 volts applied, the instrument is powered up and ready to communicate with the computer.

WARNING:

A plug or cable must be installed in the connector at all times when the instrument is immersed in water. Failure to do so will cause corrosion to the connectors and may cause water damage in the electronics housing.

2.3 Powering the Micro Pressure Sensor

The Micro Pressure Sensor is powered externally via the communications cable. Refer to the wiring diagram in *Appendix 'C'*. The power should be a DC voltage between 8 and 16 volts. If an AML data cable is used, attach the red wire to the positive side of the power supply and the black wire to ground.

3 COMMUNICATING WITH THE MICRO PRESSURE SENSOR

To communicate with the Micro Pressure Sensor, a terminal emulation program such as HyperTerminal is required. This program provides the mechanism of communication between the instrument and an IBM-PC compatible computer. The following pages contain a brief description on how to configure HyperTerminal to communicate with the Micro Pressure Logger. When all cables have been connected properly and the appropriate baud rate/serial port combination chosen, the instrument will return the prompt (>). Once the prompt appears, the Micro Pressure Sensor is ready to accept instructions. Refer to the Micro Pressure Sensor Command Summary in *Section 3.4*.

3.1 Configuring *HyperTerminal* for Communications with the Micro Pressure Sensor

Note: If HyperTerminal has not been installed on your computer, please refer to your Windows™ manual.

1. Use the Start button on the Desktop to access the Programs Folder.
2. Open the Accessories menu.
3. Click on the HyperTerminal program to start the program.
4. Double click on the Hypertrm Icon. (*Figure 3.1*).

Figure 3.1

5. Fill in the name and choose the Icon.
6. Choose the correct communications port. (*Figure 3.2*)

Figure 3.2

7. Choose the Baud rate (19200), 8 Data bits, No Parity, 1 Stop bit and no Flow control. (*Figure 4.3*)

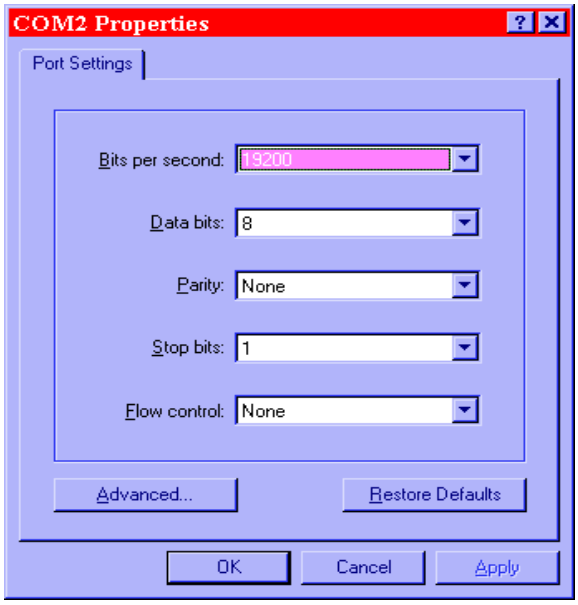


Figure 3.3

8. Press <Return> to start communicating with the instrument. (*Figure 3.4*)

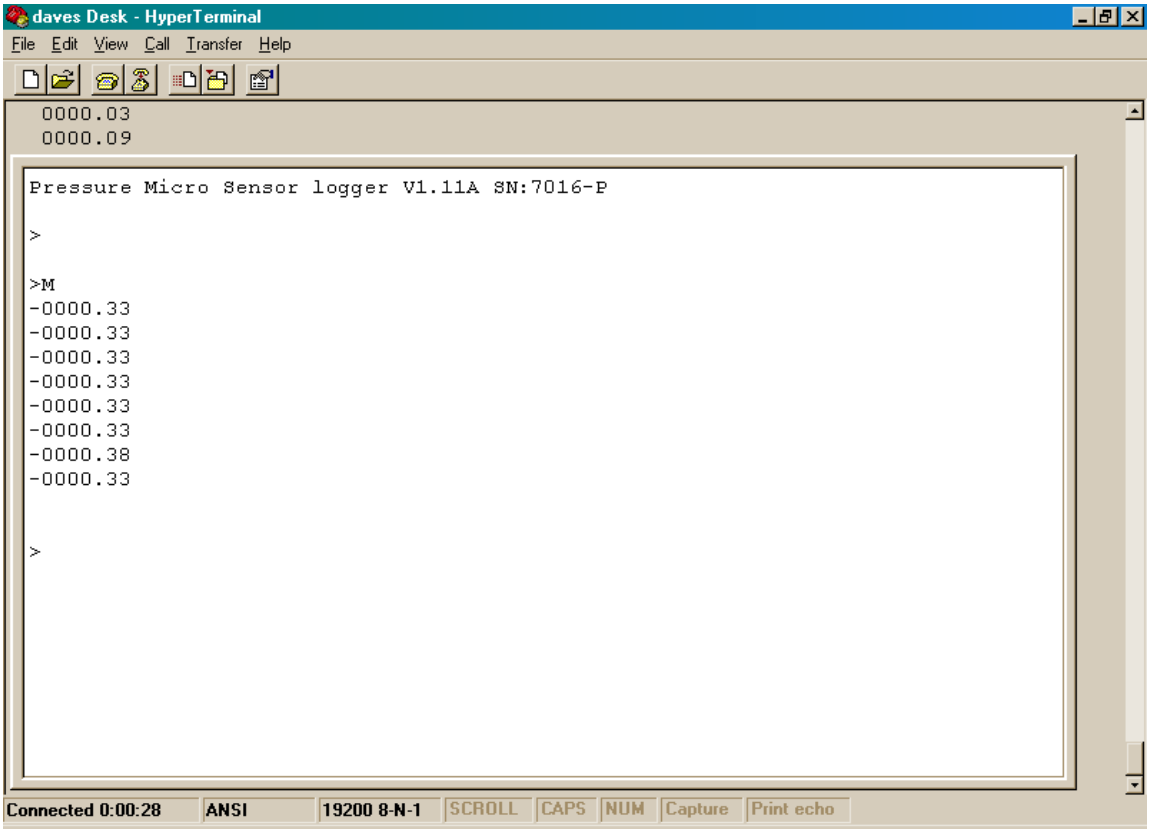


Figure 3.4

3.2 RAW/REAL Parameter Values

The Micro Pressure Sensor can display data in two modes, real or raw. Real mode displays data that has been calculated to produce engineering units.

3.2.1 Raw Data Format

Data displayed in raw mode is strictly a numeric representation of the sensor readings. The raw data is a five digit integer in the range of 00000 to 65000.

3.2.2 Real Data Format

The real data is a five digit signed number, which gives pressure in dBars expressed as the following format: ±0000.00.

3.3 COMMAND SUMMARY

All commands are in the form of standard English words. Commands can be entered in upper or lower case letters. The minimum letters of the command that the instrument will recognize are enclosed in brackets. All commands are followed by an **<ENTER>** or **<RET>**

Command: **VER** (Version)

This command will display the instrument header. The format is as follows;

Micro Pressure Sensor V1.11A SN:7016-P
>

Command: **RAW [RA]**

This command will set the instrument to output RAW uncorrected data when using the MONITOR, SCAN or DUMP commands.

Command: **REAL [RE]**

This command will set the instrument to output Real corrected engineering data when using the MONITOR or SCAN commands.

Command: **/ [/]**

This command is used to toggle RAW and REAL modes of operation.

Command: **SCAN [S]**

This command outputs one scan of data.

Command: **MON [M]**

This command sets the instrument to continuously output data at the rate programmed with the SET command. Pressing any key will discontinue the monitor command.

Command: **SET [SE] SAMPLE RATE [S]**

This command sets the rate at which the instrument will take samples (or scans). The sample rate is in the form of a number followed by the time units. The allowable time units are listed below:

CONTINUOUS [C]
/SECONDS [/S]
SECONDS [S]
MINUTES [M]
HOURS [H]

The following examples demonstrate some of the possible permutations of this command.

SET SAMPLE 6 HOUR	This will set the sample rate for one sample every 6 hours.
SE SA 30 SEC	This will set the sample rate for one sample every 30 seconds.
SET S 5 S	This will set the sample rate for one sample every 5 seconds.
SE S CONTINUOUS	This sets the sample rate at the maximum of 25 scans per second.

Command: **SET DETECT ab [SE D ab]**

Where
a = a Hex number between 0-F
b = a Hex number between 0-F

This command sets the detection mode of the instrument on power up.
The DETECT command can be used to set the Micro CTD to start up in the *Auto baud mode* or to set the instrument to default to a specific baud rate at power up.

The 'a' value represents how many times the Micro CTD will try to determine the baud rate (when the enter key is pressed) before it defaults to the baud rate set by the value of 'b'. If a = 0 the Micro CTD will not auto baud and will default to the baud rate specified by the value of 'b" at each power up.

Specific values of 'b' and the corresponding baud rates are outlined in the table below.

b value	Baud rate
1	1200
2	1200
3	2400
4	4800
5	9600
6	19200
7	38400

Example 1:

>set detect 97

In the above example, the Micro CTD will try 9 times to auto baud. If the instrument is not able to establish a baud rate, it will default to 38400 baud.

Example 2:

>set detect 05

In the above example, the Micro CTD will *not* try to auto baud, but will simply default to 9600 baud on power up.

Command: **SET SN** nnnn

This command sets the serial number of the instrument. This command is intended to facilitate integration into OEM equipment. To display the instruments serial number use the VER command.

Example:

>set sn 7245

To display the serial number,

```
>ver
Micro CTD Sensor V2.07 SN:7245-CTD
Copyright© 2001-2003, AML Oceanographic
0MB of Memory
```

Warning: Changing the instruments serial number will adversely effect the operation of Smart Talk or ISS software.

Command: **DIS C** (Display)

This command will display the instrument's current calibration coefficients.

>Dis c returns the instruments calibration coefficients

Command: **DIS S**

This command displays the current scan rate.

Example:

```
>DIS S
sample rate is 1 seconds
```

4 MAINTENANCE

The Micro Pressure Sensor has been designed to minimize user maintenance. To keep the instrument in top condition the following maintenance is required:

- After each deployment, the Micro Pressure Sensor case should be washed thoroughly with fresh water.
- Rinse (with freshwater) and dry the connector if contamination with saltwater is suspected. Saltwater inside the connector will eventually corrode the contacts causing intermittent communications.

Caution:

The pressure sensor is fragile. Contact with a sharp object to the pressure sensor face could damage it.

4.2 Main O-Ring Maintenance

Normal use of the Micro Pressure Sensor will not require the main O-ring to be changed. However, the main O-ring may be inspected periodically and greased to keep the O-ring in good condition. If during an inspection damage is suspected please do the following.

Note: Do not use sharp objects to remove the main O-ring from its groove.

1. Using the method outlined in *Figure 4.0*, use the thumb and index finger to remove the main O-ring from its groove.
2. Clean the O-ring using a tissue or clean cloth.
3. Inspect the O-ring for cuts or nicks. An eyepiece or magnifying glass will help. Replace if necessary.
4. Clean the O-ring groove located on the end cap with a swab or tissue.
5. Inspect the O-ring groove for scratches or dirt.
6. Lightly coat the O-ring with silicon grease and replace it onto the end cap.
7. Clean the O-ring surface located on the inside of the pressure housing with a swab or tissue.
8. Inspect the O-ring surface for dirt or scratches.
9. Lightly coat the O-ring surface on the inside of the pressure housing with silicone grease.

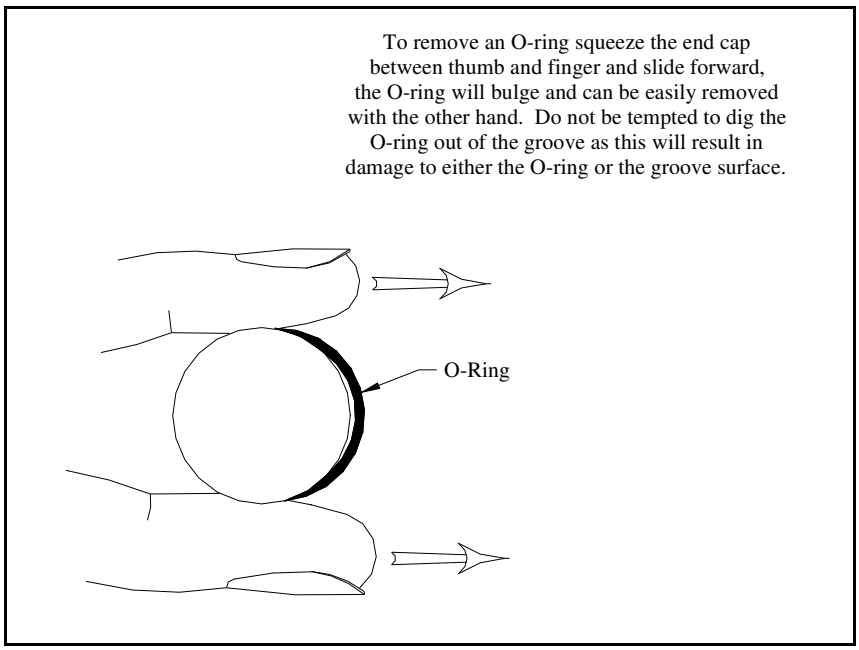

To remove an O-ring squeeze the end cap
between thumb and finger and slide forward,
the O-ring will bulge and can be easily removed
with the other hand. Do not be tempted to dig the
O-ring out of the groove as this will result in
damage to either the O-ring or the groove surface.
O-Ring

Figure 4.0

5 CALIBRATION

The Micro Pressure Sensor sensor must be calibrated occasionally. The pressure sensor was calibrated at the factory at the time of manufacture. This should remain within published specifications for periods of 1 - 2 years, depending on the amount of use, depth of deployment, and other conditions occurring in the deployment environment. Sensor accuracy is also dependent upon proper care and maintenance by the user. Re-calibration of these sensors must be done at the factory.

The sensor is calibrated by recording the instrument's raw data to known reference points at different temperatures. This data is applied to a curve fitting algorithm to produce calibration coefficients for both pressure and temperature effects. Each set of coefficients is permanently stored in the instrument's memory.

Calibration coefficients are not interchangeable. Each set is unique to each instrument. The calibration coefficients for the instrument to which this manual belongs are listed on the '*Customer Documentation CD*' sent with the instrument. The user will need these coefficients if the instrument is to be used in the RAW mode for post processing purposes.

5.1 Theory

The pressure electronics use the following formula to convert raw data to engineering units (dbar):

$$P = A+B*Npt+C*Npt^2+D*Npt^3+(E+F*Npt+G*Npt^2+H*Npt^3)*Np+(I+J*Npt+K*Npt^2+L*Npt^3)*Np^2$$

Where: P = pressure in dBar.
Npt, Np = raw values
A through L are calibration coefficients determined at the factory

APPENDIX `A': Troubleshooting Guide

The following section outlines some of the most common problems encountered by users of the Micro Pressure Sensor. A brief list of suggested solutions has been provided. If the difficulties persist, please do not hesitate to contact the **AML Oceanographic** service staff.

Problem:

Micro Pressure Sensor does not communicate with the computer.

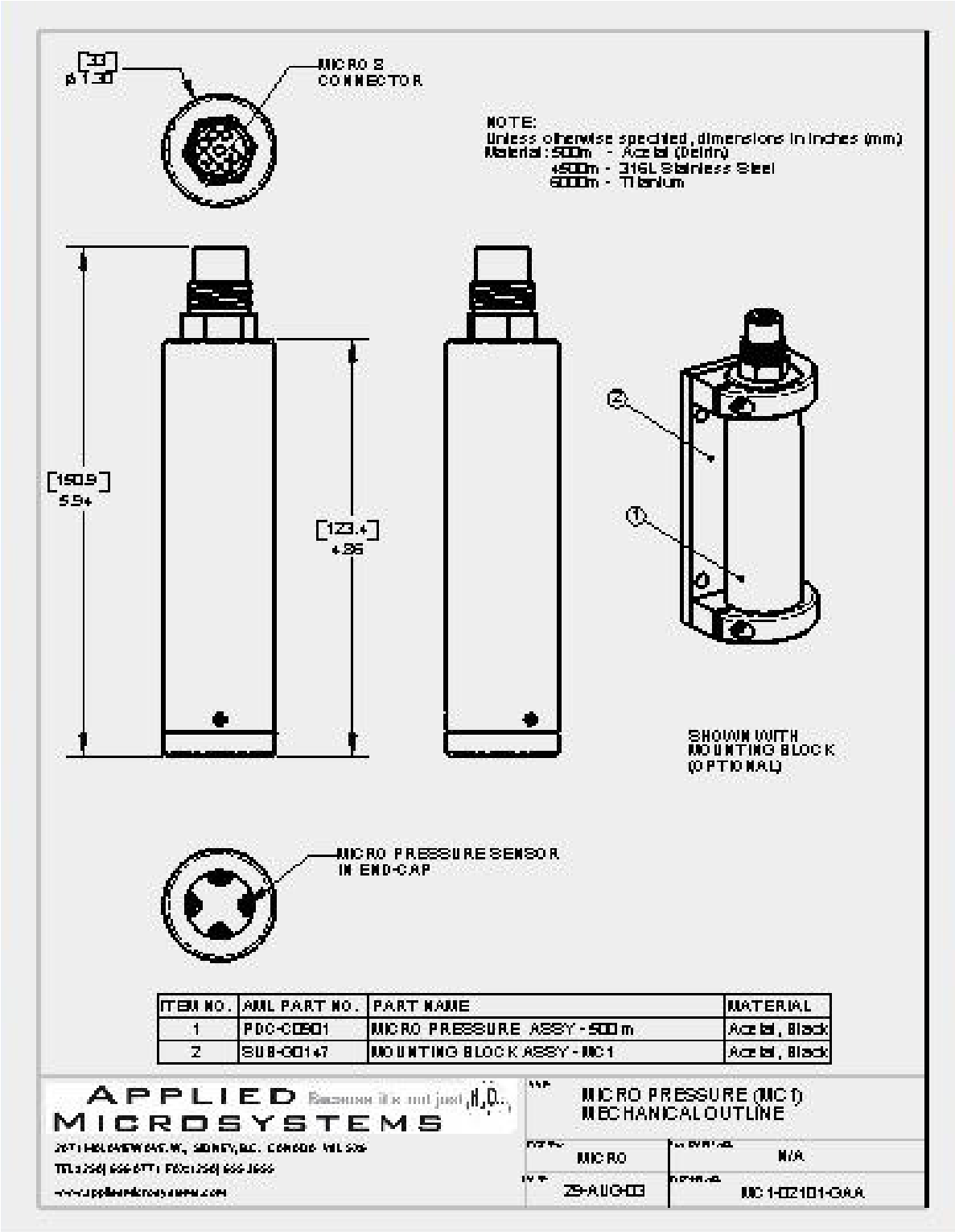
Solutions:

- Check the power supply for correct voltage setting (12 Volts DC) and or current limiting.

- The serial port chosen is incorrect. Most IBM-PC compatible computers have only one serial port; therefore the user should choose one of the COM1 settings. However, if a COM2 port exists, the user must take care in determining which port the cable has been connected to and choose the appropriate baud rate/port combination.

- The communications set up of the computer is incorrect. The Micro Pressure Sensor will be factory set to no parity, 1 stop, 8 data bits and will automatically determine the baud rate after the reception of an **<ENTER>** or **<RET**.

APPENDIX `B': General Layout



APPENDIX `C': Wiring Diagram