# Series 9 digital pressure indicator installation and operation manual

***HEISE ® SERIES 9 DIGITAL PRESSURE INSTRUMENTS***

## *INTRODUCTION*

Congratulations on your purchase of a Heise Series 9, one of the finest precision pressure measuring instruments available anywhere. These instruments are precision devices, designed to measure and indicate pressure with an extremely high degree of accuracy and are rugged enough to provide laboratory performance in field service. All parts have been designed and selected for such service and with proper care and maintenance this instrument will perform within specifications for years of trouble free service.

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***WHEN YOU SEE THESE SYMBOLS***

***IMPORTANT APPLICATION INFORMATION***

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## SECTION 1.0

## PURPOSE AND SCOPE OF MANUAL

This manual is intended to provide design and performance information. This information is intended to guide users of all models of Series 9 Digital Pressure Instruments in achieving the maximum benefits of the product.

IMPORTANT
Please read the entire manual thoroughly before using the instrument or attempting any service or repair work. The instructions in this manual are intended to be performed by qualified instrumentation or technical personnel only. This manual should be kept with the instrument or in a place of safe keeping at all times, as it contains pertinent information for operation and maintenance. Additional manuals can be ordered through Customer Service. If additional assistance is needed, contact our Customer Service Staff at:

Ashcroft Inc.
250 East Main Street
Stratford, CT 06614-5145, USA
Tel: 203-378-8281
Fax: 203-385-0246

Please be sure to include instrument model number and serial number in all correspondence to assure proper identification. Ashcroft Inc. does not recommend trouble-shooting or repairs beyond the scope of this manual. Problems which cannot be remedied by following the instructions in this manual should be referred to the manufacturer. Immediate assistance can often be supplied by telephone. Defective components will be repaired or replaced by the manufacturer at his discretion. Repaired products will be returned to the user by the same mode of shipment. Airmail and air express is recommended for urgent shipments.

## SECTION 1.1

## SAFETY PRECAUTIONS:

Electronic pressure instruments must be selected in accordance with industry codes and safety practices to avoid the possibility of misuse or misapplication which could result in personal injury or property damage. Personnel responsible for selection and installation should also be familiar with the safety recommendations of ASME B40.1, that apply to elastic pressure elements and their application in general and specific services. ANSI B40.1 is available from:

ASME
345 47th Street
New York, NY 10017

Pressure – Select a range so that the maximum applied pressure will never exceed the upper range limit.

Vibration – Excessive vibration could cause loosening of components resulting in loss of instrument accuracy or failure to provide valid data.

Pulsation – Excessive pressure pulsation could result in fatigue failure of the pressure element.

Temperature – Operation of the instrument in an environment where temperatures are in excess of design ratings may result in loss of accuracy and failure.

Process – Pressure boundary materials must be resistant to the process media. Failure to assure compatibility may result in pressure sensing element deterioration or failure. Instruments used on high pressure gas, or potentially hazardous service, such as oxygen should be carefully selected in accordance with the recommendations of ANSI B40.1.

Hazardous Location – Only approved explosion proof or intrinsically safe instruments should be used in hazardous locations.

Electro-Magnetic Interference – Instruments should not be used in locations where EMI/RFI conditions exceed design ratings, to avoid erroneous performance.

***WARNING – THESE INSTRUMENTS ARE NOT EXPLOSION PROOF OR INTRINSICALLY SAFE. POWER LEVELS PRESENT PRECLUDE USE IN HAZARDOUS LOCATIONS.***

***SECTION 1.2*** ***WARRANTY INFORMATION***

All Heise Products and Parts carry a warranty against defective material or workmanship for a period of one (1) year from the date of shipment. (See complete policy, page 27)

***SECTION 1.3*** ***LIMITATION OF LIABILITY***

A complete warranty and limitation of liability statement is made on the standard quotation form at the time of sale. (See complete statement, page 27)

***SECTION 2.0*** ***BASIC DESIGN AND FEATURES***

The Series 9 Precision Instrument is a powerful pressure measurement and digital display system integrating the patented Heise optical pressure sensor with sophisticated microprocessor controlled software that performs profiling to compensate for non-linearity and ambient temperature effects. The Series 9 ia available with guaranteed accuracy of ±0.07% F.S. or optionally it can be supplied with accuracy of ±0.035% F.S. Several optional features enable the instrument to perform a variety of functions beyond the basic requirements of pressure measurement. Easy access to the circuit boards and the sensor simplify service and allow for many optional features to be installed in the field.

***SECTION 2.1*** ***MODELS 901A AND 901B***

Series 9 instruments are offered with two standard grades of accuracy. Model 901A has a rated accuracy ±0.07% of span suitable for most general purpose applications. For more demanding applications, the Model 901B is supplied with a rated accuracy of ±0.035% span. Each instrument is furnished with a certified calibration sheet traceable to the NIST (formerly NBS). A variety of standard measuring ranges are available from 2 psig through 30,000 psig and from 5 psia through 30,000 psia. Standard performance specifications are maintained throughout the complete pressure range listing. Accuracy ratings do not diminish with higher pressure ranges.

***SECTION 2.2*** ***ACCURACY DEFINITION***

The basis of the specifications described in this manual are as follows: Accuracy is defined as the combined effects of non-linearity (terminal based), non-repeatability, and hysterisis as compared to a primary standard of at least ±0.020% of reading accuracy at reference conditions. The temperature is held within a window of 72° ±3°Fahrenheit. It does not include the uncertaintity of the dead weight standard. Our calibration systems comply with the requirements of ANSI/NCSL Z540-1 and our quality systems are certified to comply with the requirements of ISO 9001. Certificates of calibration accompany each unit and include actual readings of from ten to twenty test points both up scale and down scale.

***SECTION 2.3*** ***THEORY OF OPERATION***

The Heise Pressure Sensor incorporates an optical means of detecting the effect of pressure on an elastic member, therefore, there is no physical contact between the strained member, acted upon by pressure, and that portion which produces the electrical signal. This unique pressure sensor is the heart of the extraordinarily accurate Heise Series 9 line of precision instruments. The fundamental operation of the sensor is quite simple. The diaphragm or small helical Bourdon tube element moves only 0.020 inches during a full span excursion, almost imperceptible to the eye. This small motion and the use of high strength materials result in minimum stress levels, well below metal yield points, to assure stability, repeatability, and long sensor life. Fixed to the element is an opaque vane, like a “miniature window shade,” which blocks near infrared light impinging on one of two monolithic photodiodes. The other photodiode continuously measures the intensity of the light source, an LED. The near infrared wave length emission intensity produced by the LED is regulated by a feedback circuit using the output of the fully exposed diode. The primary function of the microprocessor as the central control element is linearization and temperature compensation of the mea-

sured pressure. During the calibration procedure, a pair of EEPROMS are programmed to correct for inherent deviations of the pressure sensor. Analog voltage pressure signals from the sensor are converted to raw count digital signals 12 times a second (83 mS). Every third conversion (250 mS) value is read by the microprocessor and corrected with a software controlled algorithm to compensate for sensing element nonlinearity. Up to twenty (20) calibration points are utilized for profiling a sensor. A temperature sensing diode bonded to the sensor body provides temperature signals to the microprocessor. Approximately every 60 seconds a correction offset for zero and span is calculated and applied to the readings based upon temperature change from the calibration reference temperature.

## SECTION 3.0 INSTALLATION AND OPERATION

### INSPECTION

Before discarding packaging materials verify that you have removed all accessories shipped with the instrument. At a minimum, you should have a power cord, operations manual and a certificate of accuracy. Also present may be a handle, panel mounting hardware or other related accessories depending upon mounting and optional features selected. DO NOT DISCARD PACKAGING MATERIALS until you are satisfied with the “as received” condition of the Series 9 Instrument. Claims for damaged or missing goods may require inspection of the shipping materials by an authorized factory or carrier representative.

## SECTION 3.1 MOUNTING

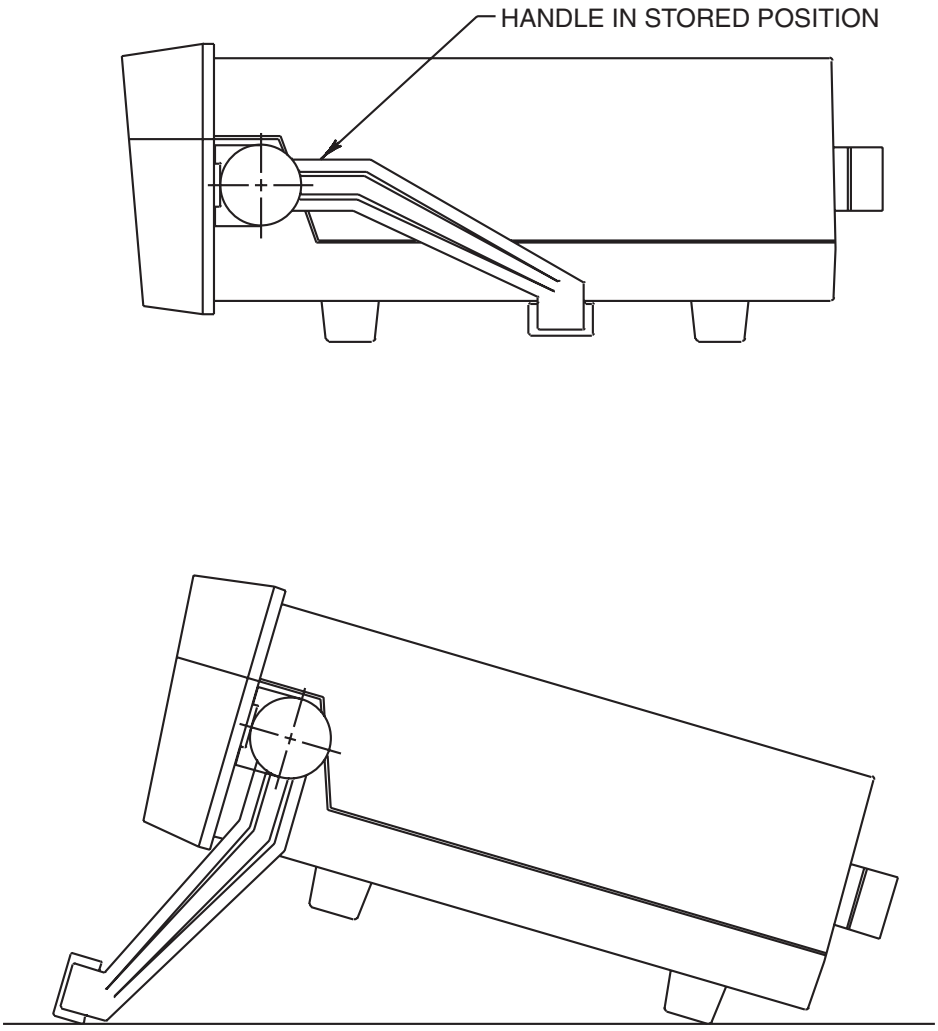
Three mounting configurations are available: bench, handle and panel. Bench units are shipped with four rubber feet mounted to the case bottom for resting the unit on a flat surface. The optional handle fills a dual role. When rotated 90 degrees it is a convenient prop raising the display to a comfortable viewing angle of 20 degrees. When rotated forward to a horizontal position, it serves as a carrying handle for easy transport. When not in use, the handle may be swiveled underneath the unit for storage. (See Figure 1.) To change the handle’s position, grasp the ends of the handle at the case pivot points and simultaneously flex them outward from the case approximately $^1/_4$ inch on each side. Rotate the handle to the desired position and gently release the ends. Move the handle slightly back and forth until its ends lock in place. Handle units also include four rubber feet mounted to the bottom of the case. Optional panel mounting brackets can accommodate any panel thickness up to $^1/_4$ inch. Panel mounting hardware consists of two shoulder screws, left and right side brackets, and four pan head restraining screws. (See Figures 2 and 3.)

1. Thread the four pan head screws approximately $^1/_8$″ into the tapped holes in the left and right side mount-ing brackets.
2. Slide the instrument into the panel opening from the front of the panel until the bezel meets squarely with the panel surface.
3. From the back of the panel thread the two shoulder screws into the threaded inserts located behind the instrument bezel on the sides of the case.
4. Hook the brackets over the shoulder screws. Flat side of bracket should be against the side of the case.
5. Tighten the four pan head screws until the instrument is firmly held in the panel.

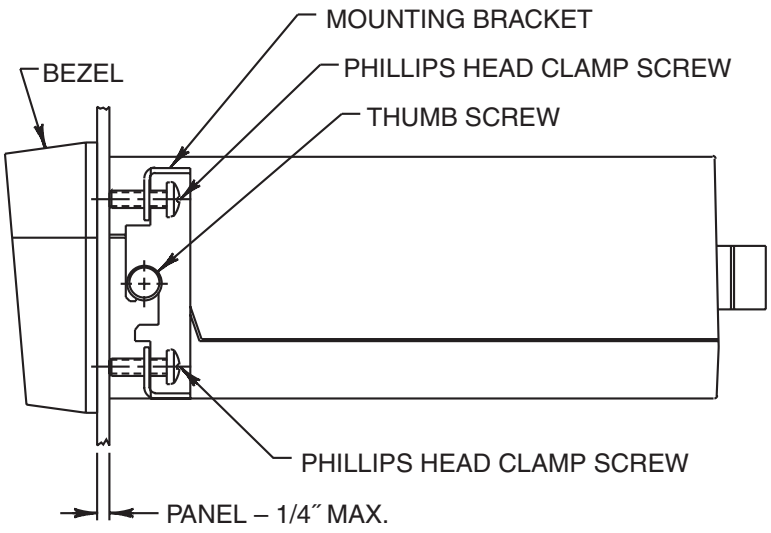
**Note:** In applications where a Heise Series 9 is replacing a Heise Series 7 indicator, a panel mount retrofit panel (p/n 859X087-01) is available to adapt the Series 9 to the larger panel opening.

Firmly press power cable receptacle over power input terminals located at the rear of the instrument. Connect the power cable plug to a suitable power supply outlet. The nameplate on the bottom of the instrument identifies the power requirements. Activate the unit by depressing on/off switch located on front panel.

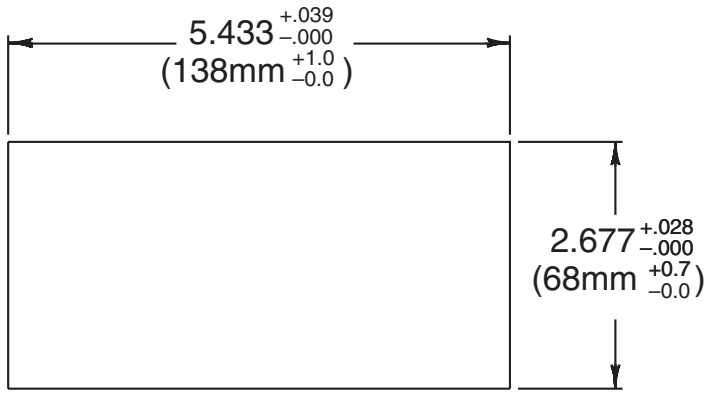
# Figure 1
HANDLE KIT



# Figure 2
PANEL MOUNT KIT




# Figure 3
PANEL CUTOUT



***SECTION 3.2***

***INITIAL POWER UP***

At this time check display for any malfunction. During normal startup “HEISE” will appear for a moment on the display and then be replaced with pressure data. If a malfunction occurs contact the factory for assistance.

***SECTION 3.3***

***PRESSURE INLET CONNECTION - ALL TYPES***

To insure user safety, always disconnect the power cable prior to connecting the pressure line. Then connect the pressure line to the inlet port located at the rear of the instrument. The standard inlet fitting for pressure ranges up to and including 5,000 psi is $^{1}/_{4}$ NPT Female thread. For pressure ranges over 5000 psi a $^{9}/_{16}$-18 UNF-2B Female high pressure port for $^{1}/_{4}$˝ O.D. tubing (AMINCO 45-11310/AUTOCLAVE F250-C) is standard. Reconnect the power cable and switch the unit to the “on” position.

***SECTION 3.4***

***OVERRANGE/UNDERRANGE***

For all pressure types, if the rated full scale range is exceeded, it will continue to indicate pressure values for approximately an additional 10% of the range. When the pressure or vacuum level exceeds the range by 10% the display will lose all numeric values and indicate “Or” for overrange or “Ur” for underrange. Returning to a value of less than 10% overrange or underrange will return numeric data to the display.

**Caution:** Pressuring the unit to the point of overrange indication may require re-zeroing or may cause damage to the sensor.

***SECTION 3.5***

***WARM UP TIME***

The warm up time is 5 minutes to rated accuracy and 30 minutes for complete stability for 901A’s. The warm up time for 901B’s is 10 minutes to rated accuracy and 90 minutes for complete stability. More than one zero adjustment may be required if the instrument is to be used before the complete warm up time.

***SECTION 3.6***

***ZERO ADJUSTMENT PROCEDURES***

Adjusting zero on all Series 9 models will require use of a small blade screwdriver. Additional equipment may be required depending on the pressure type (gauge, absolute, etc.). It is important that sufficient warm up time be allowed before adjustments are made. Failure to allow sufficient warm up time may result in “chasing” apparent “zero drift”. Determine the model and pressure type of your unit(s) and follow the procedure in the appropriate section below.

**Note:** As the Series 9 zero reference is position sensitive, be sure that the instrument is in the position or attitude of final use during the zeroing procedure. (i.e. If the unit is to be propped to 45° via the handle, it should be zeroed in this position)

***SECTION 3.6.1***

***GAUGE PRESSURE AND VACUUM (ZERO ADJUSTMENT)***

With zero pressure applied (connection open to atmosphere) adjust the display to indicate all zeroes by rotating the zero adustment screw. Apply pressure to the inlet and check all connections for leakage. In the absence of any leakage proceed with use. Caution: Be sure that the pressure source does not exceed the instrument’s rated pressure range.

***SECTION 3.6.2***

***ABSOLUTE PRESSURE (ZERO AJDUSTMENT)***

To adjust zero on an absolute pressure indicator a vacuum must be applied to the instrument. A absolute pressure of 25 microns or less is sufficient for zero adjusting of all absolute ranges. In most cases this will require the use of a high performance vacuum pump and a precision manometer or absolute deadweight tester. The actual vacuum level required is dependent upon the pressure range of the Series 9 and should be at least half the value of the least significant digit. Apply appropriate vacuum level and zero display using zero adjust screw. In the absence of any leakage proceed with use.

***SECTION 3.6.3***

***COMPOUND PRESSURE (ZERO ADJUSTMENT)***

To adjust zero on a compound range unit a vacuum must be applied to the instrument. Although a typical compound range (eg. –30-0-30 inches Hg) indicates “zero” with no pressure applied,
**Function:**
The tare option digitally returns the display to zero regardless of the pressure reading. Its primary uses are with leak test applications, pressure preload removal, or to temporarily convert absolute pressure indication to gauge pressure indication.

**SECTION 3.6.3**

**COMPOUND PRESSURE (ZERO ADJUSTMENT)**

the zero pot should not be used to adjust this display value. “Zero” is actually adjusted at –28 inches Hg because the span of the instrument is 60 inches Hg total. A reference point of 28 inches Hg vacuum (appx 13.75 psi vacuum, etc.) is used as the reference point since there are very few locations or circumstances in which 30 inches Hg vacuum can be achieved. In most cases this will require the use of a precision manometer or absolute dead weight standard.

**SECTION 3.6.4**

**ANALOG OUTPUT (ZERO ADJUSTMENT)**

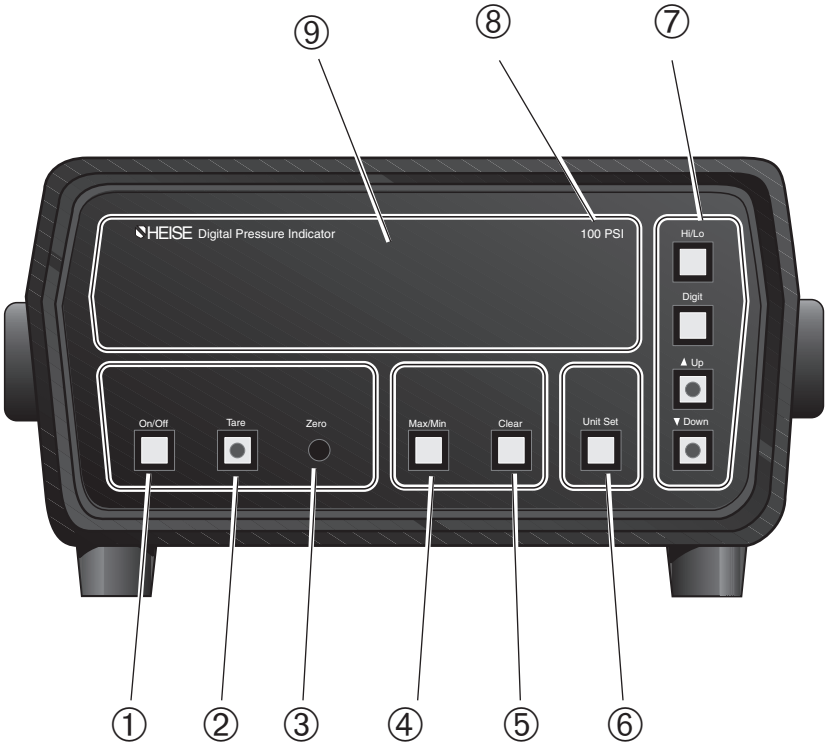
Refer to section 6.2.2, page 17

**SECTION 4.0**

**FRONT PANEL FEATURES**

Each Series 9 instrument comes with two standard front panel features: front panel on/off switch and front panel zero adjustment. Up to four optional front panel features are also available. These options are easily identified by the presence of switches in the outlined boxes on the front panel. Blank boxes indicate certain optional features were not included at the time of manufacture.

**Note:** Series 9 units can be upgraded with most optional features at a later date, if desired consult factory.




1-Power switch
2-Tare button
3-Zero adjust potentiometer
4-Max/ Min recall button
5-Max/Min clear button
6-Engineering unit select button
7-Hi/Lo setpoint programming buttons
8-Maximum pressure range
9-Digital display

***SECTION 4.1*** ***TARE FUNCTION***

**Operation:**
Depress the switch once, the display is automatically zeroed. A status light at the end of the switch is illuminated, indicating that a display correction or offset is in effect. Depress the switch again, the display resumes its normal reading and the switch status light is extinguished.

**Function:**
The function of the Max/Min option is to recall to the display the highest and lowest pressures measured during tests such as valve testing, burst testing, compression or tensile strength testing. As pressure is changing, the unit's microprocessor compares and saves pressure values that exceed previously sensed values. The pressure values are read 12 times (83mS) a second to capture peak values.

***SECTION 4.2*** ***MAX/MIN-CLEAR***

**Operation:**
The clear switch serves to erase previously saved data on command allowing a new pressure cycle to be saved and recalled later. If a higher or lower pressure is sensed while the unit is displaying a maximum or minimum value, the display will be updated with the new value. During normal operation the Series 9 display responds to increasing and decreasing pressure changes. When the Max/Min switch is depressed once, a light segment indicating the word "Max" will appear to the left of the display. The new displayed pressure value will be representative of the maximum applied pressure and will not change unless a new max value is measured or until the Max/Min switch is pressed again. A second push of switch button will illuminate the "Min" light segment located directly beneath the Max light and will concurrently display the minimum applied pressure reading. A third push of the switch will return the display to normal mode. Max and Min values are retained in memory and may be recalled repeatedly until cleared. The clear switch may be depressed at any time to remove previous max and min values. Once the values have been cleared, new values are written to memory.

**Function:**
Unit select allows the operator to convert pressure readings from a primary engineering unit to various alternate engineering units such as bar, mm Hg,in $H_20$, etc., without having to resort to a look-up table or a calculator for conversion. In addition to pressure units the microprocessor can also be programmed at the factory to display unique values that are linearly proportional to pressure. For example pounds force, feet of sea water, and percent. Unit select may also be used to reduce the resolution of the display by one least significant digit each time the unit select button is depressed. Unwanted pressure variations can then be disregarded if desired.

***SECTION 4.3*** ***UNIT SELECT***

**Operation:**
Each time the unit select button is depressed the pressure reading is scaled with one of three preprogrammed values. Simultaneously, a light bar adjacent to the display illuminates the respective engineering unit legend. When "powered up" the display will default to the primary engineering unit.

**Function**:
The Hi/Lo setpoint feature continually compares the measured pressure to two setpoint values installed by the operator and stored in EE PROM memory. Pressure excursions beyond the setpoints are indicated by status lights on the "Up" or "Down" buttons on the front panel and result in a corresponding change

***SECTION 4.4*** ***HI/LO SETPOINT***

**Function:** (Continued)
in relay states. Relay hookups are accessible on the rear panel "D" connector. (refer to section 5.0 for pinout configuration). Four front panel push button switches are used to review existing setpoint values and for entering new values into EE-PROM

**SECTION 4.4**

**HI/LO SETPOINT (CONTINUED)**

storage. Status lights denoting Hi and Lo settings are contained in the ends of the Up and Down switches. The lights illuminate corresponding to a pressure in excess of the programmed value. Lights extinguish automatically when the pressure returns to a value within the limits of the setpoints. A single relay driver rated for 30 Vdc maximum at 300 mA is associated with each setpoint. The normal contact mode is closed when the pressure is within the setpoints. In this mode a circuit path to the coil of an external relay can be completed allowing the external relay to be held in either an open or closed state depending upon user requirements. See Section 5.4, page 16 for a typical wiring schematic with pin out designations. Driver status is considered “fail safe” since a power failure to the instrument will cause the driver to open, thereby breaking the coil circuit which in turn would cause the external relay to change state.

**Operation:**
Installation of a new setpoint value is accomplished by entering the setpoint programming mode. To enter the programing mode depress the “Hi/Lo” button once. This will initiate display of the current setpoint values. While the setpoints are being displayed depress the “digit” button located directly beneath the “Hi/Lo” push button. Instruments equipped with the password lockout feature will read “CodE ?” for approximately two seconds indicating that you have entered the password lockout feature which preceeds the programming mode. After this message is displayed the primary engineering unit light will flash and the remainder of the display will go blank.

**Note:** If the instrument is not equipped with the password lockout feature the front panel will display the word “Hi?” indicating that you have entered the setpoint programing mode. Skip the following section and procede to section 4.4.2 – Setpoint Configuration.

**SECTION 4.4.1**

**PASSWORD LOCKOUT**

Standard Series 9 instruments are configured with a software password lockout feature to prevent unauthorized personnel from changing the Hi and Lo setpoint values. The factory programmed password is the 5 digits following the “S9” prefix in the serial number, unless a different number was requested at the time of purchase. Alternate passwords can be any number from 0-199999 consisting of six digits or less. Changes to the password can be made by the factory only.

As described in section 4.4.2 “ Setpoint Configuration” the Series 9 front panel will go blank after displaying the message “CodE?” with the exception of the engineering unit light bar which will continue to flash. This is the prompt for the user to enter the password. Begin password entry by depressing the “digit” button. The numeral zero will appear at the least significant digit (LSD) location. The value of this display is changed by pressing the “Up” or “Down” button as many times as necessary to achieve the proper value. The “Up” button increases the value while the “Down” button decreases the value. When the proper first digit is displayed, depress the “Digit” button once. The current display value will shift one position to the left and the numeral zero will again appear in the LSD position. Repeat the digit entry process until all the digits to the password are complete.

**Note1:** If an improper digit was selected, depress the digit button repeatedly until the display is blank except for the numeral zero in the LSD position. Repeat the digit entry process.

**Note 2:** Prior to confirmation you may escape back to the password entry mode by depressing the digit switch instead of the Hi/Lo switch. Repeat the password entry procedure as necessary.

**Note 3**: If an improper password is entered the display will indicate “Err” and then return to normal pressure indication. Re-initialization of the setpoint programing procedure is required to resume changing the setpoints. With the proper password number appearing on the front panel, depress the Hi/Lo switch. The dis-

***SECTION 4.4.1***

***PASSWORD LOCKOUT (CONTINUED)***

play will begin to flash requesting you to confirm the entry. Confirmation is completed by depressing the Hi/Lo switch a second time. Upon acceptance of the password the display will indicate "Hi?" signifying you are entering the setpoint installation mode commencing with the high setpoint value. Depress the "Digit" button once to start entry of a new Hi setpoint value. The display will go blank except for the decimal point and engineering unit light bar which will begin flashing.

Setpoint entry steps are the same for both Hi and Lo setpoints. If the new setpoint is to be a negative number it is necessary to set the polarity (±) before entering the value. Depressing the "Up" button will place a negative sign on the display. To remove it press the "Up" button again. Pressing the "Down" button will

***SECTION 4.4.2***

***SETPOINT CONFIGURATION***

cause the decimal point to shift to the left, however, the decimal point position is already located in the proper position for the pressure range and should not require relocation. To return the decimal point to its proper location, press the "Down" button repeatedly until the decimal point is properly located. With proper polarity and decimal point location indicated, depress the "Digit" button. The numeral zero will appear in the least significant digit (LSD) location. Input the first digit value of the setpoint by pressing the "Up" or "Down" button until the desired value is displayed. The "Up" button increases the value while the "Down" button decreases the value. When the desired first digit value is displayed, depress the "Digit" button once. The entered value will shift one position to the left and the numeral zero will appear in the LSD position. Repeat the digit entry process until all the digits to the setpoint are complete. To confirm the entry, press the Hi/Lo button once. By depressing this button a second time, the Series 9 will offer the opportunity to change the Lo setpoint by displaying "Lo?". Repeat the above digit entry procedure should a new value be desired. If not, depress the Hi/Lo button once and the instrument will resume normal pressure indication.

**Note 1:** If the setpoint value is less than a whole number, it is not necessary to input zeroes to the left of the decimal.

**Note 2:** If an improper digit was selected, depress the digit button repeatedly until the display is blank as it was when you began setpoint entry. Repeat the digit entry process.

**Note 3:** To change only the Lo setpoint, depress the "Hi/Lo" button once while the front panel displays "Hi?". The display will then indicate "Lo?". Depress the "digit" button once and the display will go blank except for the decimal point and engineering unit light bar which will begin flashing. Procede as above. With the proper setpoint appearing on the front panel, depress the Hi/Lo switch. The display will begin to flash requesting you to confirm the entry. Confirmation is completed by depressing the Hi/Lo switch a second time.

**Note 4:** Prior to confirmation you may escape back to the digit entry mode by depressing the digit switch instead of the Hi/Lo switch. Repeat the digit entry procedure as necessary.

Existing Hi and Lo setpoints may be reviewed during normal operation by depressing the "Hi/Lo" button. The Hi setpoint value will be displayed followed by the Lo setpoint. Review of both setpoints takes approximately six seconds.

***SECTION 4.4.3***

***SETPOINT VERIFICATION***

**Note:** During review/verification, all microprocessor controlled output functions are temporarily interrupted. After setpoint review the display resumes normal pressure indication.
Several input/output functions are available with the Series 9 Digital Pressure Instrument. They are made available by the selection of an option card, specified at time of order.
Some of these features can be installed in the field at a later date. See section 6.4.3 "Field Installation of Output Options Cards" page 20 for details.

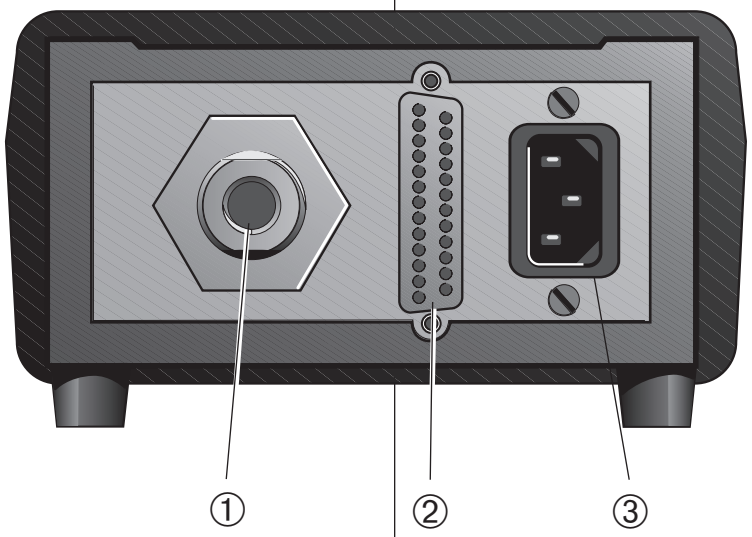
***SECTION 5.0***

***REAR PANEL FEATURES***

Rear panel Options:
Analog: 0-5 Vdc, 0-10 Vdc & 4-20mA
Digital: RS-232C & Tri-state Parallel BCD
Hi/Lo Relay Driver
Display Hold
Remote sensor

A “D” type electrical connector on the rear panel serves as the communications port for all input and output signals except for the remote sensor option. A 25 pin female connector is provided for all interfaces except BCD. To accommodate the additional number of connections for BCD output, a 44 pin female connector is installed. If no output or input signals are included a molded connector plug is inserted into the panel. The plug is removable to accommodate adding options at a later date. A Bendix connection is provided in place of the process connection for remote sensor units. The Series 9 can be equipped with analog output, a digital output or both.

A display hold function is available that allows you to “freeze” the displayed data and the digital output data. When the display hold pin is pulled low the microprocessor completes its current update and then suspends activity until the state of the display hold pin changes. The status of the display hold line is available on the display hold acknowledge pin. The analog output signal however *is not* affected by display hold and will always respond to a change in pressure. Display hold is included with any output option card.




1–Process connection. (or Bendix connector receptacle for remote sensor units)

2–Plastic plug or “D” connector on units equipped with Hi/Lo or output options. (25 Pin for RS-232, 44 Pin for BCD)

3–Power cord receptacle.

**Function:**
Units equipped with the analog output option obtain the signal from the sensor signal conditioning circuit board prior to A/D conversion and digital linearization. The circuit hardware is capable of providing a 0/5 Vdc, 0/10 Vdc or 4-20mA signal.

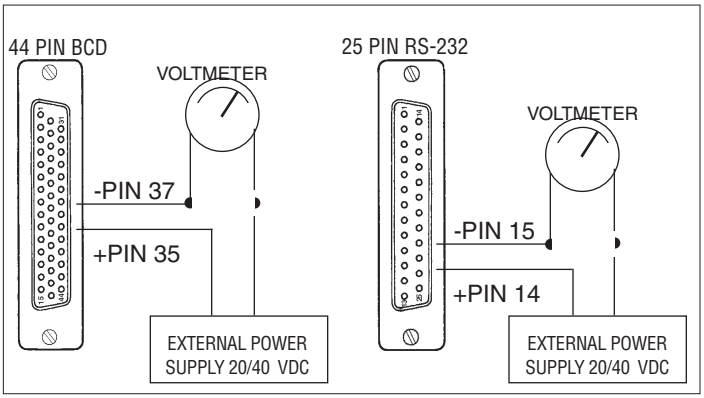
The 0/5 Vdc or 0/10 Vdc outputs are supplied directly by the Series 9. The 4-20mA output requires the use of an external power supply of 20 to 40 Vdc (see figure 1) . The Series 9 in this case serves as a current regulator to the external supply as measured by a reference resistor value. The scaling of variable resistors to set output zero and span is the only physical distinction between output configurations. (Refer to section 6.2.2, page 17 for calibration instructions).

***SECTION 5.1***

***ANALOG OUTPUT***

**Operation:**

Figure 1 – 4-20mA Pinout Assignment




***SECTION 5.2***

***RS-232 OUTPUT***

**Function:**

The RS-232 serial input/output data link is designed for interface with computers and controllers. The Series 9 serial signal can be adjusted to 1200, 2400 & 9600 baud rates to facilitate communication compatibility with accessory devices.

**Operation:**

RS-232 Interconnections:

To connect a personal computer to the RS-232 connector, connect the PC's transmit signal to pin 2; next, connect the receive signal to pin 3; lastly, connect the ground to pin 7.

**Note:** The Series 9 does not utilize a handshaking protocol. Consult your PC manual regarding its interface requirements.

***SECTION 5.2.1***

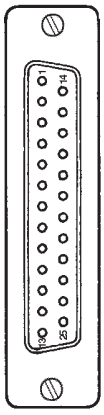
***25 PIN CONNECTOR SIGNAL ASSIGNMENT - RS-232 OPTION CARD***

*Pins 2, 3, 23 & 24 have different functions when the RS-232 output option is not provided. See pin assignment alternatives below.

2. + 5 Vdc Isolated
3. N/C
23. Display Hold In (pick up + 5 Vdc supply from pin 2 or an alternate external source)
24. Display Hold Return (return supply to pin 7)

("D" receptacle located on the back of 901 is pictured)

| Description | Pin # |
|---|---|
| RS-232 (RCV)* | 2. |
| RS-232 (TX)* | 3. |
| RS-232 (CTS) | 4. |
| RS-232 (RTS) | 5. |
| N/C | 6. |
| Ground | 7. |
| N/C | 8. |
| Lo Alarm Collector Input | 9. |
| Hi Alarm Collector Input | 10. |
| N/C | 11. |
| N/C | 12. |
| + Vdc (0/5-10 Vdc Output) | 13. |



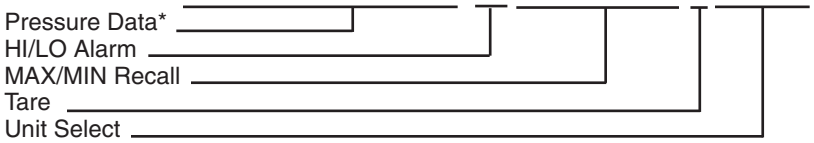
| Pin # | Description |
|---|---|
| N/C | 1. |
| 14. | 4/20 ma Output (+) |
| 15. | Analog Output (-) all |
| 16. | N/C |
| 17. | N/C |
| 18. | N/C |
| 19. | Hi/Lo Alarm Collector Return |
| 20. | N/C |
| 21. | N/C |
| 22. | N/C |
| 23. | A/D (Display) HOLD INPUT* |
| 24. | A/D (Disply) HOLD ACK* |
| 25. | N/C |

***SECTION 5.2.2***

## *RS-232 SWITCH FUNCTIONS*

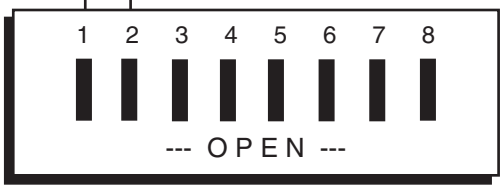
Character Format:
8 bit, no parity, one start bit, two stop bits(fixed).

Data String: (±), MSD, D4, D3, D2, LSD, H/L, NRM/MAX/MIN, T, U1/U2/U3




**SWITCH SETTINGS:** An eight position DIP switch is located on top of the RS-232 option card. The data string content, baud rate and transmit functions are controlled by adjustment of the switch positions. Switches one and two are used in conjunction with each other to set the serial link baud rate. Switches three through eight determine the content of the data output string.

| SW-l | SW-2 | Function |
|---|---|---|
| Closed | Closed | Test Mode |
| Open | Closed | 9600 Baud |
| Closed | Open | 2400 Baud |
| Open | Open | 1200 Baud |




| | | |
|---|---|---|
| SW-3 | Closed | Eng. Units Off |
| | Open | Eng. Units On |
| SW-4 | Closed | Tare Off |
| | Open | Tare On |
| SW-5 | Closed | Hi/Lo Off |
| | Open | Hi/Lo On |
| SW-6 | Closed | Min/Max Off |
| | Open | Min/Max on |
| SW-7 | Closed | Line Feed Off |
| | Open | Line Feed On |
| SW-8 | Closed | Pace Mode |
| | Open | Free Run Mode |

Engineering Unit Select (SW-3): If the unit is equipped with the engineering select Option, this switch adds or removes the engineering unit Data (U1, U2. U3) from the data stream.

Tare Function (SW-4): If the unit is equipped with the “tare” option, this switch adds or removes the tare indicator from the data stream.

Hi/Lo Alarm (SW-5): If the unit is equipped with the “Hi/Lo Alarm” option, this switch adds or deletes the alarm indicator, from the data stream.

Min/Max Value (SW-6): If the unit is equipped with the “Min/Max Value” option, this switch adds or deletes the min/max indicator from the data stream.

Line Feed (SW-7): A line feed may be added or removed from the end of the data string.

Pace/Free Run (SW-8): The “pace” mode waits for a Carriage Return signal before sending a data string. The “Free Run” mode continuously transmits all selected data at the desired baud rate set by switches 1 and 2.

*See Appendix A, page 25 for sample basic program.

***SECTION 5.3***

## *BCD OUTPUT AND HANDSHAKE PROTOCOL*

The Series 9 is available with tri-state parallel BCD as an output option (See figure below for 44 Pin BCD connector assignments). Interface with data acquisition equipment is accomplished through a simple data-ready/data-inhibit control protocol. This allows the user to recognize when new data is being placed in the BCD latches and to inhibit updating of the latches when data is being processed.

The BCD option board has its own micro-processor. When the processor has new data the “Data Ready” signal is brought low. The processor then monitors the “inhibit” line for a period of ten milliseconds. If the “inhibit” line is activated during the ten millisecond monitoring period, the processor will not send the new data to the BCD latches. The processor raises the “data ready” line and waits to receive another packet. If the “inhibit” line is not activated during the 10 millisecond period, the new BCD data is placed in the BCD latches for transmission. The processor then raises the “data ready” line and starts the process over.

**Note:** Pins 42 (display hold) and 40 (display hold acknowledge) do not have to be utilized in order to operate the BCD interface. These signal lines are provided to give the user a means of freezing the front panel display (via the BCD line from the acquisition controller) if desired, and acknowledging that it has been done.

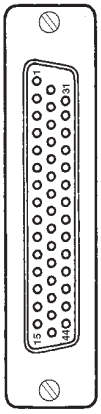
**Note:** Pin 31 (TRI-STATE). Early versions of the BCD option card marked “Rev A through “Rev D”, require that this pin be pulled low in order to operate the BCD interface. Option boards marked “Rev D” or higher utilize a jumper (marked JP1) on the option board to pull this line low. The user need not do this externally to operate the BCD interface, however. If tri-state operation is desired the user must remove the jumper at JP1.

***SECTION 5.3.1***

## *44 PIN CONNECTOR SIGNAL ASSIGNMENT - BCD OPTION CARD*

**Operation:**
Decimal point character, if applicable, will appear between MSD position and LSD position relative to the display.
(“D” receptacle located on the back of 901 is pictured)

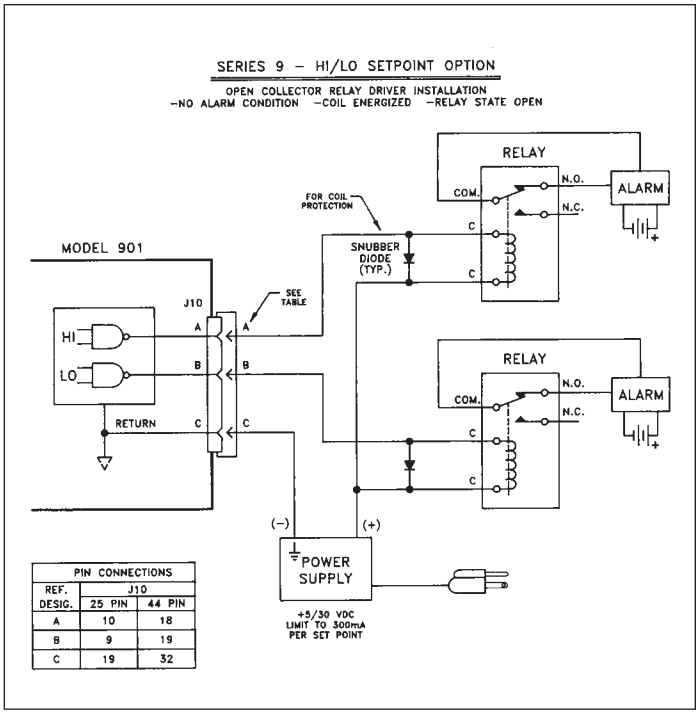
| Description | Pin # |
|---|---|
| 1 MSD | 1. |
| 2 MSD | 2. |
| 4 MSD | 3. |
| 8 MSD | 4. |
| INACTIVE | 5. |
| TARE | 6. |
| Polarity Sign, Positive Sign High | 7. |
| N/C | 8. |
| 1 D3 | 9. |
| 2 D3 | 10. |
| 4 D3 | 11. |
| 8 D3 | 12. |
| 1 D4 | 13. |
| 2 D4 | 14. |
| 4 D4 | 15. |
| Min Value | 16. |
| Max Value | 17. |
| Hi Alarm Collector Input | 18. |
| Lo Alarm Collector Input | 19. |
| Decimal Point D2 | 20. |
| Decimal Point D3 | 21. |
| Decimal Point D4 | 22. |



| Pin # | Description |
|---|---|
| 23. | Decimil Point D5 |
| 24. | 1 bit LSD |
| 25. | 2 bit LSD |
| 26. | 4 bit LSD |
| 27. | 8 bit LSD |
| 28. | 1 D2 |
| 29. | 2 D2 |
| 30. | 4 D2 |
| 31. | Tri-State (Normally High) |
| 32. | Hi/Lo Alarm Collector Return |
| 33. | Ground |
| 34. | Unit Select-Binary 2 |
| 35. | Analog (4/20mA) out (+) |
| 36. | Analog (0/5,0/10VDC) out (+) |
| 37. | Analog Return (-) All |
| 38. | DATA READY |
| 39. | INHIBIT |
| 40. | A/D (DISPLAY) HOLD ACK |
| 41. | Unit Select - Binary 1 |
| 42. | A/D (DISPLAY) HOLD INPUT |
| 43. | 8 bit D2 |
| 44. | 8 bit D4 |

**SECTION 5.4**

## SERIES 9 – HI/LO SETPOINT OPTION, TYPICAL INSTALLATION




**SECTION 5.5**

## SERIES 901 RTS (REMOTE TRANSDUCER SYSTEM)

The Heise Series 901 RTS provides the accuracy of a self contained digital indicator and the flexibility of transducer "component" system. Total digital accuracy is assured because the RTS is calibrated and temperature compensated as a complete system. The Series 901 RTS eliminates concern for the "inaccuracies" typical of a separate transducer, supply, meter and cable system. An additional feature is the accesibility and convenience of zero adjustment from the display front panel. The 901 RTS is provided complete with cables of 5, 10 or 20 foot lengths and all the necessary mating connectors. All of the standard features and options of the Series 901A and 901B are available with the RTS option.

Operation of the Series 901 RTS is the same as the general procedures in section 4.0 "Installation and Operation" with the following exceptions. A cable of five, ten or twenty feet in length will be supplied as specified at the time of purchase. If desired a cable of different length can be purchased at a later date. Please contact the factory for current pricing on the following part numbers:
828X078-01: Five foot cable.
828X078-02: Ten foot cable.
828X078-03: Twenty foot cable.
Cable should not exceed 20´, as signal loss may result.

Interconnection of the digital display and transducer is made via Bendix connectors at both ends.

**Note:** one connector is labeled "sensor". This end must be connected to the sensor to insure proper shielding of the cable. Select a mounting position for the transducer (stem mount). Mount the transducer and connect the cable to the transducer and indicator. Zero adjustments are made using the "Zero" potentiometer located on the front of the display unit. Adjust zero following procedures under section 3.6, page 7.

**SECTION 6.0**

## FIELD CALIBRATION - MODEL 901A AND 901B

**SECTION 6.1**

## CALIBRATION STANDARDS

The standard calibration tolerance for Series 9 instruments is ±0.07% of span for Model 901A and ± 0.035% of span for the Model 901B. Included within this tolerance are uncertainties for linearity, repeatability and hysteresis. Calibrations are performed at a reference temperature of 72° ±3° Fahrenheit.

***SECTION 6.1***

***CALIBRATION STANDARDS (CONTINUED)***

A primary pressure standard with an uncertainty of 0.02% of reading (or better) should be used to properly check or calibrate the displayed value. At a minimum, correction for local gravity effects, air buoyancy and temperature should be applied to the pressure standard to compensate for ambient environmental conditions.

**Note:** If a suitable primary standard is not available, it may be possible to use a secondary transfer standard, however it must be of the same range as the instrument being tested and have a minimum accuracy of ± 0.02% of span or better.

***SECTION 6.2***

***CALIBRATION PROCEDURE GENERAL***

Field calibration is limited to adjustments of zero and span. Linearity corrections are programmed into EEPROMs at the time of factory calibration and under normal use will not require reprogramming. In the event EE PROM data is lost, replacement EE PROMS may be obtained from the factory. Linearity data is kept on file by serial number providing a complete history of each unit. See section 6.4.2, page 20 for EEPROM replacement instructions.

Turning the zero or span adjustment potentiometer counter clockwise will decrease the displayed value while turning it clockwise will increase the diplayed value. Zero adjustments are the same as those outlined in section 3.6, page 7 and are performed from the front panel of the instrument. Span adjustment requires the application of full scale pressure with a suitable pressure standard and adjusting the span potentiometer (located on the sensor) until the displayed valued agrees with the known value. After adjusting span, verify the zero indication. If there has been a zero shift, re-zero the display and repeat the procedure until both the zero and span display values are within tolerance.

**Note 1:** A variable degree of position sensitivity is common to all instruments depending on pressure range. This is simply a zero shift and can be completely corrected by making a zero adjustment once the instrument is in its final mounting orientation.

**Note 2:** Units equipped with optional selectable engineering units need only be adjusted in the primary engineering unit. The displayed value of the second and third engineering units is determined by a simple software conversion of the primary engineering unit, therefore, corrections applied to the primary engineering unit will automatically correct the second and third engineering units.

***SECTION 6.2 .1***

***CALIBRATION – 901A AND 901B***

Zero adjustment is performed from the front panel of the instrument at the pot access hole “Zero” (refer to section 3.6, page 7 for details). Span adjustment will require removal of the top half of the instrument housing (see section 6.4.1, page 20). The span potentiometer is located under the rubber access boot located on the sensor. The boot is embossed with three pairs of letters; AZ (analog zero), AS (analog span), and DS (display span). The potentiometer corresponding with the letters “DS” is used to adjust span. The zero and span “pots” provide an adjustment range of approximately ±3% of the instruments F.S. rating. With the instrument properly zeroed and using a suitable pressure standard, apply 100% of the pressure range of the instrument. After making adjustments, verify that the indicated values for zero and span are within tolerance. Repeat the procedure if necessary until the displayed reading agree with the pressure standard.

***SECTION 6.2.2***

***CALIBRATION 901A AND 901B REMOTE SENSOR***

The zero and span adjustment procedures are the same as those outlined above with the exception of access to the span adjustment potentiometer. Removal of the top half of the unit housing is not required since the potentiometer adjustment boot is accessible on the remote sensor.

***SECTION 6.2.3***

***CALIBRATION – ANALOG OUTPUT OPTION***

Analog output signals of 0/5 Vdc, 0/10 Vdc or 4-20mA are available as options to the Series 9. These signals are taken directly from the pressure sensor and their linearity, zero and span

***SECTION 6.2.3*** ***CALIBRATION ANALOG OUTPUT OPTION (CONT.)***

characteristics are independent of the display adjustments. The calibration procedure is the same as that outlined above with the following exceptions. Both the zero and span potentiometers are located on the sensor. The zero adjustment potentiometer corresponds with the letters “AZ” embossed on the rubber access boot while the span adjustment potentiometer corresponds with the letters “AS”. Locate the appropriate potentiometers and follow the prcedure outlined above. (**Note:** The analog output is rated at ±0.2% FS accuracy regardless of model.)

***SECTION 6.3*** ***TROUBLE SHOOTING AND FIELD REPAIR***

***SECTION 6.3 .1*** ***TROUBLE SHOOTING GUIDE***

Often an apparent problem will have a simple solution. The following table lists some common questions or problems and their solution. Problems not covered in this section should be referred to the factory.

**Q. Unit won’t operate – no display**
**A.** Check power cord insertion in AC receptacle at rear panel.

**Q. Power cord checks out OK. Still no operation**
**A.** Early Series 9 units were equiped with a battery operated power on/off switch. Battery is dead. Contact factory for temporary repair measures.

**Q. Display unstable, drifts.**
**A.** Although the Series 9 provides a high degree of temperature correction, the display is still subject to change with ambient temperature changes. Refer to “Maximum Temperature Effects” specification, section 8.0 page 23.

**Q. As received calibration data disagrees with certification.**
**A.** With instrumentation of this caliber, calibration tolerances of test equipment are critical. For example, if you employ a test standard which is rated at 0.01% of reading, it also has an additional uncertainty. Also, the Series 9 is calibrated at a highly stable reference temperature of 72° ±3° Fahrenheit. Check ambient temperature and add error factor for standard and temperature to the tolerance.

**Q. After use the display exhibits a significant zero shift.**
**A.** Unit may have been overpressured. See section 6.2, page 16 for calibration procedures. If this fails to correct the problem the sensor and PROMs will have to be replaced. See section 6.4 “Field Repair” for instructions on sensor replacement or return to factory for repair.

**Q. After use readings disagree with another reference instrument.**
**A.** Check accuracy of reference instrument and add worst case numbers. Insure that proper equipment and calibration procedures were followed for absolute or compound ranges.

**Q. Display unstable, least significant digit jump or flickers.**
**A.** The Series 9 has extremely, high sensitivity to pressure. Insure that presssure source is stable and that valves or other system equipment are performing correctly.

**Q.Unable to get communication over RS-232 lines**
**A.** Insure that DIP switches for data format and transfer speed are properly configured on acquisition device and Series 9. See section 5.2.2.

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### *SECTION 6.4 FIELD REPAIR*

**CAUTION:** Field service of Series 9's should only be performed by a qualified electronic instrumentation technician. The Series 9 contains CMOS IC's and standard precautions should be taken in handling components. Power levels present are hazardous and could cause serious inury.

**WARNING:** DO NOT attempt to repair or perform diagnostic procedures on the power supply assembly; it contains high voltage levels and is not field servicable. If a problem with the power supply is suspected return the instrument to the factory for repair.

**CAUTION:** Always disconnect the instrument from line power before attempting any work on the unit. Due to the requirements for specialized diagnostic equipment, field repair is limited to replacement of complete assemblies such as pressure sensor and EEPROMs or output option cards.

### *SECTION 6.4.1 REMOVAL OF CASE TOP COVER*

Some operations such as span adjustment and zero and span adjustment of analog outputs will require that the top cover of the case be removed to access the pressure sensor.

**DISSASSEMBLY:** Insure that the Series 9 has been disconnected from line power. Place the unit on top down and remove the four (4) screws holding the rubber feet to the bottom of the unit and place them to the side. Turn the unit back over on its base and gently lift the top cover away from the unit. The sensor and other circuit components can now be accessed.

**REASSEMBLY:** Reverse the procedure above.

### *SECTION 6.4.2 REMOVAL OF PRESSURE SENSOR AND EE PROM IC'S*

In the case of sensor damage from inadvertent over pressure, the sensor and its mating EE PROMS can be replaced in the field. This will require purchase of the proper sensor and EE PROM set. Please consult factory with the following information for price and delivery.

- Model Number
- Unit Serial Number
- Primary Pressure Range
- Options

**To replace sensor (on conventional 901 with sensor mounted inside the indicator):**

1) With power cord removed, turn indicator upside down, remove the four screws (in bench-mount applications, these 4 screws would be holding on the rubber feet as well).

2) Carefully rotate the indicator back to the right-side-up position.

3) Lift off the top of the case.

4) Disconnect plug-in cable from the end of the sensor.

5) On the exterior (back plate) of the indicator, locate the inlet fitting. Around the inlet fitting is a large jam nut. Using a large wrench or wide-opening pliers, turn the nut counter-clockwise and remove.

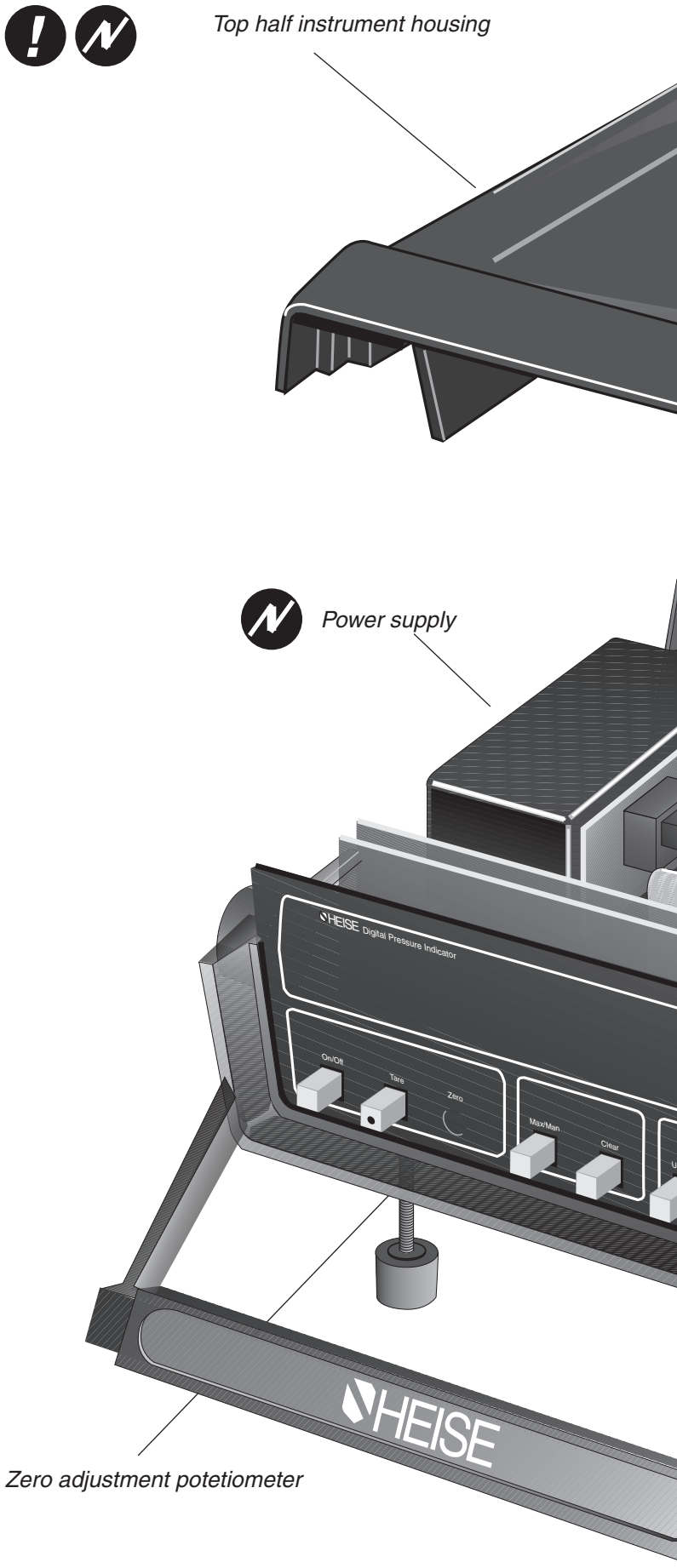
6) Remove the sensor from the indicator cavity.

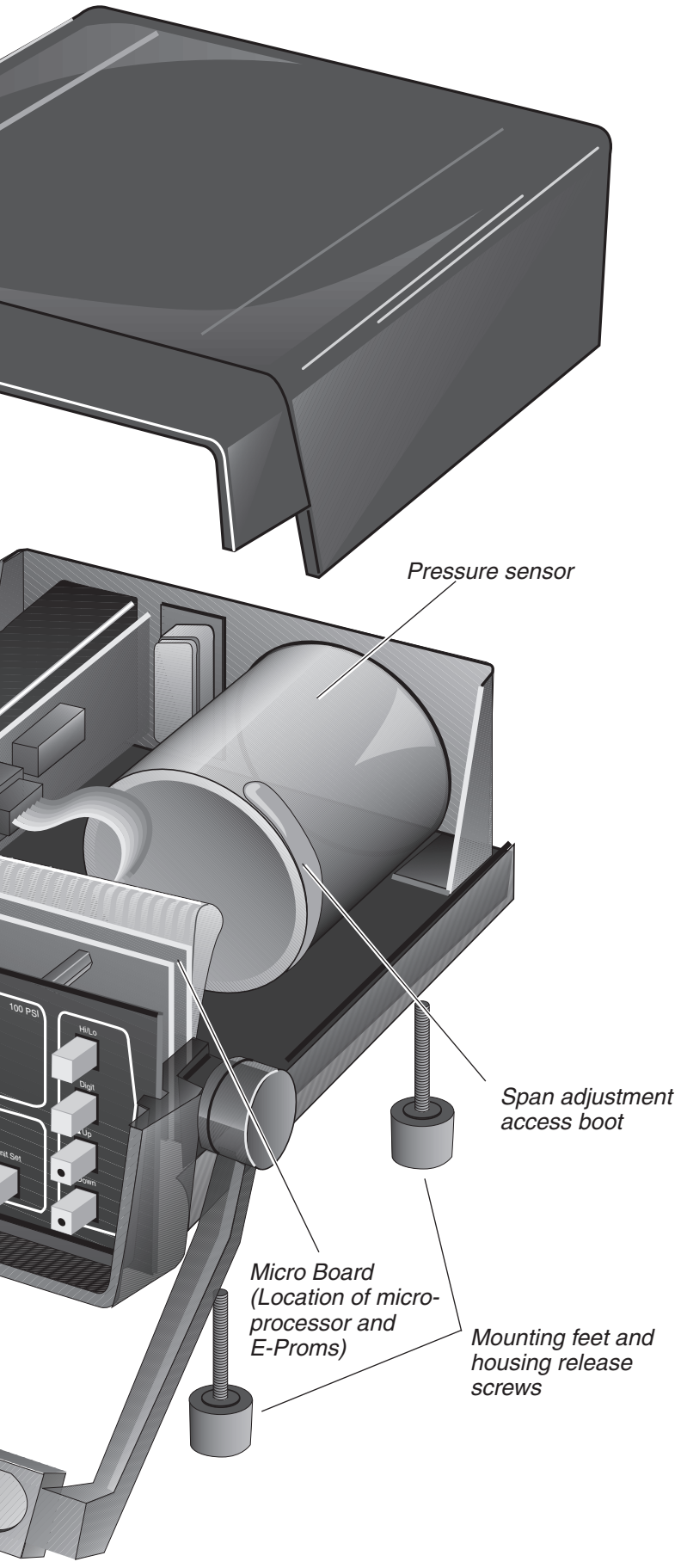
7) Install the new sensor, following the opposite procedure.

**To replace sensor (on 901 configured with the remote sensor option):**

1) Locate the Bendix connector at the end of the remote sensor cable. This connector fastens the sensor to the cable. Turn the release collar on the Bendix connector counter-clockwise.

2) Remove old sensor.






3) Install new sensor by connecting to end of cable and turning collar clockwise until sensor is locked onto the Bendix connector.

**To replace PROM chip (for conventional and remote sensor configurations):**

1) Locate the “Micro Board”, which is upright and attached to the display board set.

2) Remove the socketed PROM ( position U1, as indicated in the attached illustration) by gently prying the PROM chip from the socket.

**Note:** Earlier model 901 indicators were equipped with 2 PROM chips, located in position U1 and U2. In this case, remove both of the existing PROM chips (from positions U1 and U2) and insert the new single PROM chip into the U1 socket, per step 3 below. The U2 socket will be left empty. In addition, the large microprocessor chip located in position U3 must be changed to accommodate the single PROM configuration. (Microprocessors rev. 3.3 or earlier support 2 PROM configurations only. For single PROM configurations, rev. 3.41 or later is required). If a new micro-processor chip was not provided, please contact the factory and request P/N 832X012-03. To change the microprocessor chip:

a) The chip is attached to a socket. The socket has a lever that serves to lock the chip into the socket. Thus, the lever must be released so that it is pointing upward (extending perpendicular to the board).

b) With the lock released, remove the microprocessor and replace it with the new chip. Be sure that the prongs have not bent and are properly engaging the holes in the socket. Note that the chip has a notch on one end. The chip should be oriented so that the notch side is located on the side of the socket opposite from the lever.

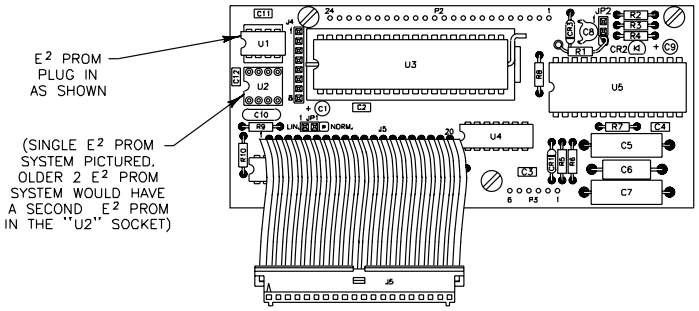
c) With the new microprocessor chip in place, lock the lever back into the down position.

3) Insert the new PROM chip into the socket, making sure that the prongs have not bent and are properly engaging the holes in the socket. Also, be sure that the notch in the chip is oriented as shown in the illustration.

4) Replace the top of the case and the four screws.

5) The installation is complete. Replace the power cord and plug in.

**Note:** After installation of a new sensor and PROM assembly, it is recommended that zero and span be checked and adjusted as necessary. Refer to section 6.2.1, page 17.




MICRO BOARD

***SECTION 6.4.3***

***FIELD INSTALLATION OF OUTPUT OPTION CARDS***

RS-232 Output and or Tri-state Parallel BCD can be installed (or replaced) in the field. To order output accessory boards use the following part numbers(consult factory for current price).
**IMPORTANT** – Please include unit Serial Number and Pressure Range with your order. This work should only be performed by qualified electronic instrument technicians.

BCD Output:
- P/N 876X051-01 Option board
- P/N 828X075-02 Connector
- P/N 828X072-02 Cable

RS-232 Output:
- P/N 876X052-01 Option board
- P/N 828X075-01 Connector
- P/N 828X072-02 Cable

Installation or replacement of output option cards require removal of the top cover as described in section 6.4 on page 20 and removal of the pressure sensor as described in section 6.4.2 on page 20.
**Replacement:** Disconnect power cable from A/C receptacle. If you are installing an output card in a unit not already equipped with one, proceed to "installation." Using a $^{5}/_{16}$ inch wrench or socket remove the two stand off bolts securing the connector to the back panel and place to the side. Gently remove the plug connecting the main PC board to the card from the card socket. Remove the single screw securing the "L" bracket on the front end of the option card to the main PC board. Remove the old option card.
**Installation:** After opening the unit and removing the sensor, remove the two (2) screws securing the power supply to the rear panel and one (1) screw securing the front of the power supply to the bottom case. Move the supply toward the display slightly to gain access to the two (2) screws securing the rear panel to the bottom case. Remove the rear panel.
**Assembly:** Install the new rear panel and secure the two (2) mounting screws. Re-install the power supply and secure the three (3) mounting screws. Install the new option board and secure its three (3) mounting screws. Install wiring harness to main PC board and option board. Re-install pressure sensor and proceed to section 5.0 for instructions on settings and operation of output options.

***SECTION 6.4.4***

***FIELD INSTALLATION OF ANALOG OUTPUT OPTION***

Analog output (0/5 Vdc, 0/10 Vdc, 4-20mA) can be installed in the field. Installation requires purchase of a new pressure sensor and an output board (if not already installed). If you do not already have an output option board installed, select one from the list above and consult factory with the instrument serial number, pressure range and options for current pricing. (Note: RS-232 or BCD output boards support analog output equipped sensors.) Installation: Follow the procedures in section 6.4 through 6.4.2 for dissassembly and installation of pressure sensor, EE PROMs, and option boards(if applicable). Calibrate the output per the instructions in section 6.2.2. Heise has a full service center dedicated to high quality and prompt service. To insure the best possible service, please be sure to pack the instrument securely to prevent possible damage in shipment and to include the following important information with the instrument.

***SECTION 6.5***

***REPAIR INFORMATION – SHIPPING INSTRUCTIONS***

Please use our web site at www.heise.com
for repair and calibration information.

***SECTION 7.0***

***905BP PORTABLE POWER PACK (NO LONGER AVAILABLE)***

The 905BP will operate for up to five hours continuously on its two six volt gel cell batteries. An integral, panel mounted DC voltmeter indicates the state of charge of the batteries. The 905BP automatically charges when connected to an AC power source and features automatic over-charge protection. The recharge cycle time is twelve hours from complete discharge.

***SECTION 7.1***

***905BP INSTALLATION AND OPERATING INSTRUCTIONS***

**CAUTION** - Insure that the AC line power ratings are the same for both the power pack and the Series 9. Never attempt to operate a 110 VAC Series 9 in a 220 VAC power pack (or vice versa) as serious damage will result to the unit.

1. Loosen thumb screw securing pressure port strain relief plate on rear of power pack. Lift plate to stops. (Remove output cable plate if applicable)
2. Firmly insert power cord (located in rear corner of power pack) to the Series 9 power cord receptacle. Carefully insert Series 9 pressure fitting through pressure port strain relief plate on power pack. Seat Series 9 in guides on base plate of power pack. Tighten thumb screw on rear of power pack.
3. Connect original Series 9 power cord to receptacle on rear of power pack. Connect power cord to appropriate AC source. Power pack will automatically enter charge mode.
4. Check state of battery charge on front panel DC voltmeter. A reading of approximately 12.2 Vdc (green zone) indicates full charge. Replace and secure power pack top cover.
5. Recharge time from complete discharge is approximately 12 hours.

**Note:** The Series 9 will exhibit zero shift when moved off horizontal plane. This is only a zero shift and is fully corrected by making a slight adjustment of the zero pot once the final operating position has been established.

***SECTION 7.2***

***SERVICE INSTRUCTIONS***

1. Field service is limited to replacement of the two 6 Vdc batteries. Heise P/N: 836X084-01Panasonic P/N: LCR 6V4PLPower Sonic P/N: PS-6401. Remove four phillips head screws from corners of base plate; lift and remove base plate. Disconnect battery cables from PC board; lift and remove batteries.
2. Install new batteries and reverse disassembly procedure. Check all connections and screws. Re-install Series 9 per instructions on power pack top cover.

***SECTION 8.0***

***GENERAL SPECIFICATIONS - 901A AND 901B***

**Sensor:** Solid state non-contacting optical sensor measuring motion of a diaphragm or bourdon tube pressure element, depending upon range. Diaphragm to 232 psi. Bourdon tube over 232 to 30,000psi.

**Sensor Wetted Materials:** Inconel 718 and 316 Stainless Steel

**Pressure Media:** Liquids or gases compatible with Inconel and 316 SS

**Process Connection:** $^1/_4$ NPT Female for ranges to 5,000 psi. $^9/_{16}$-18 UNF for $^1/_4$″ high pressure tubing for ranges 6,000 psi and higher.

**Display Accuracy:** ±0.07% of Span (901A) or ±0.035% of Span (901B). Includes linearity (Terminal point method), Repeatability and Hysteresis.

**Repeatability:** ± 0.005%

**Sensitivity:** Better than ±0.005% of span

**Analog Output Accuracy:** ± 0.2% of span for 901A and 901B indicators

**Display:** Single plane 0.43 inch high LED with decimal point and polarity. Four or five digit display (depending on range) with calibration resolution up to one part in 30,000.

**Conversion (update) Rate:** Data display and digital output signals – 250 milliseconds. Max/min track memory – 83 milliseconds. Analog output – response time 3 milliseconds.

**Warm Up Time:** 15 minutes for rated accuracy (901A) and 30 minutes for complete stability. 15 minutes for rated accuracy (901B) and 90 minutes for complete stability.

**Temperature Compensated Range:**

**Standard**: 45°F (7°C) to 95°F (35°C)

**Optional:** 20°F (7°C) to 120°F (49°C)

**Maximum Temperature Effects:** Zero: ±0.004% of Span per °F
**Span:** ±0.004% of Reading based on a reference temperature of 70° F.

**Storage Temperature:** -40°F (-40°C) to 180°F (82°C)

**Overpressure Capability:**
400% of span to 232 psi
30% of span from 250 to 10,000 psi
10% of span from 15,000 to 30,000 psi

***SECTION 8.1***

## *GENERAL SPECIFICATIONS - 901A AND 901B REMOTE SENSOR*

**Sensor Volume/Volumetric Change:**

| Range | Interior Volume | Volume change at full scale |
|---|---|---|
| 1.8-10.5 psi | 5.75 cc | .6cc |
| 10.5-232 psi | 4.55 cc | .4cc |
| 232-5000 psi | 1.15 cc | |
| 5001-30,000 psi | 0.38 cc | * |

*Volumetric change is insignificant

***SECTION 8.2***

## *GENERAL SPECIFICATIONS - 905BP PORTABLE POWER PACK*

**Power Requirements:**100/115/230 VAC nominal ±10%, 50/60Hz

**Power Consumption:** 5 Watts maximum

**Housing:** Molded high impact ABS case with black finish

**Mounting:** Bench or panel

**Weight:** 2.8 Pounds (1.3 kg)

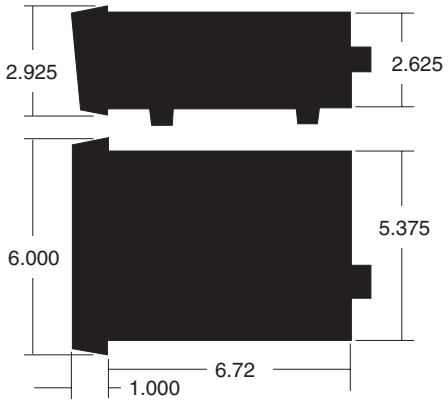
**Remote Sensor: (901RTS)Housing:** Epoxy coated Aluminum, Unsealed or sealed (optional)

**Connector cable lengths:** 5, 10 or 20 feet mating connectors included.

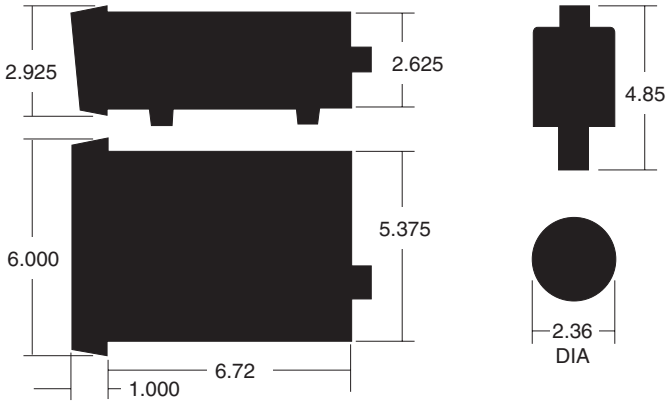
- Up to five hours continuous operation between charges.
- Twelve hour recharge time.115 VAC or 220 VAC (optional) operation.
- Weight – 12.5 lbs.(including Series 9)
- Two rear panel mounted fuses line (500mA) and battery charge circuit (1.5 Amp).
- Two rechargeable 6 Vdc Gel Cell batteries.
- Up to 400 full charge/discharge cycles (Note: cycle life will be increased by avoiding complete discharge).
- Operating temperature range: 15° to 150° Fahrenheit (note: operating time will decrease from full charge state at colder temperatures, up to 50% at 15°F).

***SECTION 8.3*** ***DIMENSIONS (INCHES)***

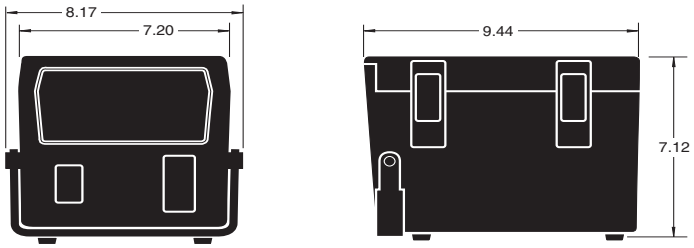
***SECTION 8.3.1*** ***901A/901B***




***SECTION 8.3.2*** ***901RTS REMOTE SENSOR***




***SECTION 8.3.3*** ***905BP BATTERY PACK (NO LONGER AVAILABLE)***



***APPENDIX A***

The following sample interface program is written in BASICA for a “PC Compatible” computer. It is set to utilize COMM1 serial port. Note that the RS-232 switch settings on the Series 9 must be configured for 1200 baud (switch 1 open. switch 2 open) and the interface must be operating in the “pace” mode (switch 8 closed).

```
 10 COLOR 7,0,0:KEY OFF:CLS
 20 LOCATE 2.18:PRINT “SERIES 9 SAMPLE INTERFACE PROGRAM”
 30 LOCATE 5,18:PRINT” COM1 DATA FORMAT: “
 40 LOCATE 7,18:PRINT” 1200 Baud”
 50 LOCATE 8,18:PRINT “ 8 Bits “
 60 LOCATE 9,18:PRINT” 1 Stop Bit”
 70 LOCATE 10,18: PRINT” No Parity”
 80 LOCATE 12,18:PRINT”Note: Series 9 must be in ‘pace’ mode.”
 90 LOCATE 13,18:PRINT “Place switch position 8 ‘Closed’”
100 LOCATE 15,18:PRINT”Series 9 will transmit after [ENTER] key is pressed.”
110 LOCATE 16,18:PRINT”Press [ENTER] key to start...’Q’ or ‘q’ to stop”
120 OPEN “COM1:1200,N,8,1,RS,CD,DS” AS #3:GOTO 170
130 A$=INKEY$:IF A$=”” THEN 130
140 IF A$=”Q” OR A$=”q” THEN CLOSE:END
150 IF A$<>CHR$(13) THEN 130
160 IF A$=CHR$(13) THEN 170
170 PRINT #3,CHR$(13)                    : REM REQUESTS ASCII DATA FROM SERIES 9
180 WHILE NOT EOF(3)                     : REM CONTINUE UNTIL DATA SET COMPLETE
190 B$=INPUT$(LOC(3), #3)                : ASSIGN DATA SET EQUAL TO B$
200 WEND
210 LOCATE 19,1:PRINT”Series 9 Data: “;
220 LOCATE 19,16:PRINT SPC(30)           : REM CLEAR LAST DATA SET DISPLAYED
230 LOCATE 19,16:PRINT B$;
240 GOTO 130
```

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**World Headquarters**

Ashcroft Inc.
250 E. Main Street
Stratford, CT 06614-5145
U.S.A.
Tel: (203) 378-8281
Fax: (203) 385-0408
(Domestic)
Fax: (203) 385-0357
(International)
email: info@ashcroft.com
www.ashcroft.com

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