

Instruction Manual

Terranova

Model 908A Dual Capacitance Diaphragm Gauge Controller



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rev100410sr

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I Safety Information



Explosive Gases



WARNING!

Do not use the Model 908A Dual Capacitance Diaphragm Gauge Controller to measure the pressure of combustible gas mixtures. The gauge normally operates at low temperatures, but it is possible that momentary transients or controller malfunction may cause ignition of combustible mixtures, which then might explode and cause damage to equipment and injury to personnel.



Limitation on use of Compression Mounts

WARNING!

Do not use a compression mount (quick-connect) for attaching the gauge tube to the vacuum system in applications that may develop positive pressures. Positive pressures may cause the tube to be blown out of a compression fitting and damage equipment and injure personnel.



Chemicals



WARNING!

Many organic cleaning solvents, such as acetone, produce fumes that are toxic or flammable. Use such solvents only in areas that are well ventilated to the outdoors and away from electronic equipment, open flames, or other potential ignition sources.

Please let us Know...

Terranova products are the most advance instruments of their type available from any manufacturer. We have made this Instruction Manual as complete and clear as possible. Let us know if you have any comments that can make this manual or our products more useful.

II

Overview

A. Front View, Back View and Dimensions



Figure 1: Model 908A front view

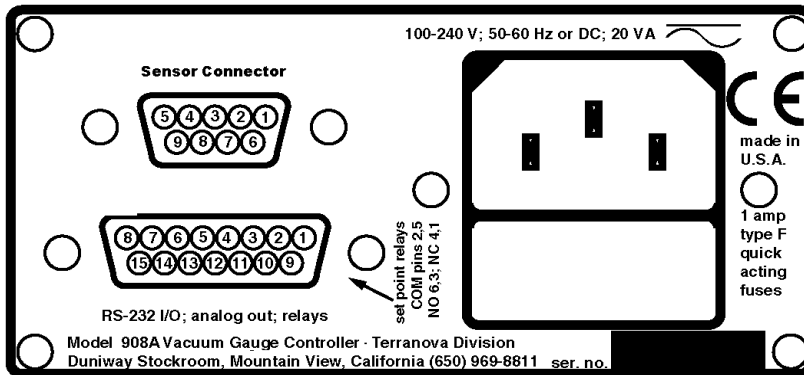


Figure 2: Model 908A rear view

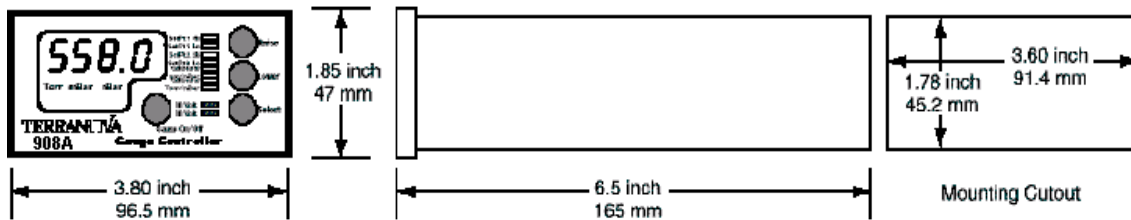


Figure 3: Model 908A dimensions

B. General Description

The Terranova Scientific Model 908A Dual Capacitance Diaphragm Gauge (CDG) Controller displays vacuum pressure as measured from capacitance diaphragm gauges. The 908A supplies ± 15 volts at up to 0.75 amp; this is sufficient to operate most heated capacitance diaphragm gauges. The 908A precisely measures the 0 to 10 volt signal from the CDG to determine pressure. The Model 908A controller covers full scale ranges from 20 mTorr to 10,000 Torr. The 908A is housed in a 1/8 DIN enclosure and is simple to operate.

C. Specifications

1. Useful Measuring Range
4 decades; for CDG tubes with full scale of 20 mTorr to 10.00 ktorr; full scale range selection is entered on the front panel by the user
2. Display Range
-9.9 torr to 10.00 ktorr; pressures higher than 130% of Sensor Full Scale displays **HI**;
3. Display Resolution
varies according to full scale range, from 0.01 mTorr to 1 Torr
4. Gauge Interface
The 908A incorporates a high-resolution input circuit which allows the use of the capacitance diaphragm gauge over its entire 4 decades.
5. Input to the 908A Controller
0 to 10 volts for full scale of the gauge
6. Units of Display
torr (mtorr), mBar (Bar), pascal (kpascal), or arb (no units); user selectable
7. Full Scale
user selectable range to match CDG FULL SCALE : 20, 50, 100 mTorr; 1, 2, 10, 100, 1000, 5,000 and 10,000 torr
8. Calibration Adjust
for calibration of display; allows user to multiply CDG response by 0.50 to 2.00
9. Vacuum Gauge
one or two capacitance diaphragm gauges which have 1-10 VDC signal output and require up to 0.75 amp total from ± 15 volt supplies; this is sufficient to operate most heated gauges

10. Operating Temperature Range
+2 to +50 deg. Celsius
11. Process Control Set Points
two, with independent High and Low set points for each relay, for flexible control of hysteresis
12. Process Control Relays
two relays; contacts rated for resistive loads:
AC: 120VA: 2.0 Amps @ 60VAC, 1.0 Amps @120 VAC, 0.5 Amps@/240 VAC.
DC: 60 Watts: 2.0 Amps @ 30 VDC, 1.0 Amps @ 60 VDC, 0.4 Amps @ 150 VDC.
13. Nonvolatile Memory
for all user specified parameters
14. Analog Output
logarithmic, 0.5 volts/decade; 0.10 mTorr=0.5 volts, displays pressure for selected gauge
15. Output Power
+15 at 0.75 amp and -15 volts at 0.75 amp; sufficient to operate temperature-controlled gauges
16. Mounting
The 908A may be used as a bench-top instrument or it may be mounted in an instrument panel. Clips are provided for panel mounting.
17. RS-232 Input/Output
allows user to read pressure and set points; 9600 baud, 8-N-1; available through the accessory connector
18. Operating Voltage
The Model 908A has a universal power supply, which operates on input voltages from 90 VAC to 240 VAC 47 to 65 Hz; input is through a standard IEC 320 instrument power input receptacle on the rear panel; input power is protected by fuses in both lines of the input power.
19. Weight, Model 908A only; does not include cable or CDG
0.9 lb. /0.4 kg

D. Controls and Indicators

1. GAUGE SELECT button
allows the user to select which of the two gauges are shown on the digital display
2. SELECT button
Allows selection of parameters to be adjusted, e.g. Set Points

3. RAISE and LOWER buttons
used for adjustment of gauge and instrument parameters
4. Digital Display
4-digit 7-segment bright red LED, 10 mm high
5. Display Indicators
bright red individual LED for miscellaneous indicators

E. Capacitance Diaphragm Gauge Suppliers

CDGs may be ordered from several sources, including the following:

Duniway Stockroom Corp.
1305 Space Park Way
Mountain View, California 94043
USA

telephone	(650) 969-8811
toll-free	(800) 446-8811
facsimile	(650) 965-0764
email	info@duniway.com
internet	www.duniway.com

MKS Instruments, Inc.
Six Shattuck Rd.
Andover, Massachusetts 01810
USA
telephone (978) 975-2350
toll-free (800) 227-8766
facsimile (978) 975-0093
internet www.mksinst.com

III Installation

A. Unpack the Controller

Carefully unpack the Model 908A Dual Capacitance Diaphragm Gauge Controller. The shipment includes these components:

- controller unit
- power cord
- mounting clips, fuses
- D-sub 15 accessory connector
- this instruction manual

If your controller does not have all of these items, call Duniway Stockroom. If anything appears to have been damaged in shipment, contact the shipper.

If you need a gauge cable for connection to the Model 908A, please contact Duniway Stockroom.

Do not plug the power cord in yet.

B. Mount the Controller

You can rest the controller unit on a bench, table top, or shelf, or you can mount it in a rack or cabinet. The controller unit is housed in a standard 1/8 DIN box. If you are mounting the unit in a panel, the cutout dimensions are 1.78 inch by 3.60 inch (45.2 mm by 91.4 mm), see fig. 3, page 9. One mounting clip attaches to each of the sides of the controller unit. To attach the clip, slide the beveled surfaces of the clip under the cutout on the side of the box and push the clip toward the back of the unit.

Be sure to leave enough clearance at the back of the controller unit for easy access to cable connections.

C. Select the CDG

The Model 908A controller is designed to work with standard capacitance diaphragm gauges which operate on ± 15 volts. If you have difficulty obtaining a CDG, please contact us at Duniway Stockroom.

CAUTION

Use of a CDG other than those which operate from ± 15 volts may cause damage to the CDG.

D. Connect the CDG

Make sure that the CDG is securely connected to the vacuum system, using good vacuum practice.

E. Attach the CDG Cable

The CDG cable has a 9-pin D-sub connector on one end, which plugs into the 908A, see Figure 4, below. There are a variety of conventions for connection to the CDG; you may assemble or modify the cable to adapt to the CDG as needed. Connect the 9-pin D-sub plug of the gauge cable to the 9-pin connector on the back of the 908A controller unit. Push the plug onto the connector until it is firmly in place. Tighten the retaining screws to make certain the connector remains in place. Loose connections can cause faulty readings.



Figure 4: Model 908A Sensor Connector -- 9 Pin Female D-Sub Connector

NOTE

The following information will allow you to make modifications to the cable as needed to interface with your CDG. Please refer to Figure 4 above; this shows the 9-pin connector which is on the rear panel of the 908A. This connector has female sockets; the mating connector on the CDG cable must have male pins

908A 9-pin 'D'			to MKS Baratron 15-pin 'D'	
<u>908A Pin</u>	<u>Terranova Name</u>	<u>Color</u>		<u>Tube Pin/Connection Name</u>
1	Tube #1 Signal	white	to:	Tube#1, Pin 2/Signal Output
2	Tube #2 Signal	white	to:	Tube#2, Pin 2/Signal Output
3	Tube #2 Signal Return	brown	to:	Tube#2, Pin 12/Signal Common
4	+15 volts	red	to:	Tube#1, Pin 7/+15 VDC
5	+15 volts	red	to:	Tube#2, Pin 7/+15 VDC
6	-15 volts	green	to:	Tube#1, Pin 6/-15 VDC
7	-15 volts	green	to:	Tube#2, Pin 6/-15 VDC
8	Tube #1 Signal Return	brown	to:	Tube#1, Pin 12/Signal Common
9	Electronics Common	black/shield	to:	Tube#1,Pins5/Pwr.Comm & 15/& Chassis Gnd
9	Electronics Common	black/shield	to:	Tube#2,Pins5/Pwr.Comm & 15/& Chassis Gnd

Figure 5: 908A -- MKS Baratron Pin Connections (15 pin)

Note: Many other manufacturer's gauge pin connections use this same pin configuration.

908A 9-pin 'D'			to MKS Baratron 5-pin Molex	
<u>908A Pin</u>	<u>Terranova Name</u>	<u>Color</u>	<u>Tube Pin/Connection Name</u>	
1	Tube #1 Signal	white	to:	Tube#1, Pin 3/Pressure Out
2	Tube #2 Signal	white	to:	Tube#2, Pin 3/Pressure Out
3	Tube #2 Signal Return	brown	to:	Tube#2, Pin 2/Output Return
4	+15 volts	red	to:	Tube#1, Pin 5/+15 VDC
5	+15 volts	red	to:	Tube#2, Pin 5/+15 VDC
6	-15 volts	green	to:	Tube#1, Pin 4/-15 VDC
7	-15 volts	green	to:	Tube#2, Pin 4/-15 VDC
8	Tube #1 Signal Return	brown	to:	Tube#1, Pin 2/Output Return
9	Electronics Common	black/shield	to:	Tube#1, Pin 1/Pwr.Comm & none
9	Electronics Common	black/shield	to:	Tube#2, Pin 1/Pwr.Comm & none

Figure 6: 908A -- MKS Baratron Pin Connections (5 pin)

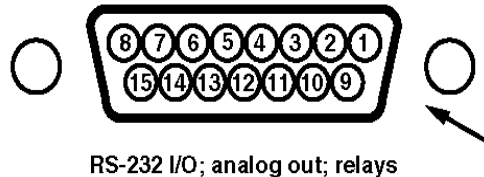
Current available for +15 volts from pins 4 and 5, and for -15 volts from pins 6 and 7 is internally protected and limited to approximately 0.75 amp total for each supply. For example, this allows CDG #1 and CDG #2 to draw 0.375 amp each; or CDG #1 may draw 0.72 amp and CDG #2 may draw 0.03 amp. If excessive current is taken through any of the power output pins, the internal protection will shut off the power for the affected voltage. It will be necessary to disconnect power for the 908A for a few minutes to allow the internal protection device to cool down and reset itself.

908A 9-pin 'D'			to MKS Baratron 9-pin 'D' (i.e. 750B)	
<u>908A Pin</u>	<u>Terranova Name</u>	<u>Color</u>	<u>Tube Pin/Connection Name</u>	
1	Tube #1 Signal	white	to:	Tube#1, Pin 1/Pressure Out
2	Tube #2 Signal	white	to:	Tube#2, Pin 1/Pressure Out
3	Tube #2 Signal Return	brown	to:	Tube#2, Pin 8/Output Return
4	+15 volts	red	to:	Tube#1, Pin 4/+15 VDC
5	+15 volts	red	to:	Tube#2, Pin 4/+15 VDC
6	-15 volts	green	to:	n/a
7	-15 volts	green	to:	n/a
8	Tube #1 Signal Return	brown	to:	Tube#1, Pin 8/Output Return
9	Electronics Common	black/shield	to:	Tube#1, Pin 9/Pwr.Comm & none
9	Electronics Common	black/shield	to:	Tube#2, Pin 9/Pwr.Comm & none

Figure 7: 908A -- MKS Baratron Pin Connections (9 pin 'D')
(This applies to CDG sensor tubes such as the Baratron 750B)

F. Make Accessory Connections

The 15-pin D-sub Accessory Connector is on the rear panel of the 908A, see Figure 8, below. The connector has female pins; the mating connector must have male pins. Mating D-sub 15 connectors are available from many of the normal electronic sources. If you need help identifying a source, please contact us.



RS-232 I/O; analog out; relays

Figure 8: Model 908A Accessory Connector -- 15 Pin Female D-Sub Connector

Following are pin assignments for the Accessory Connector:

15-pin

pin 1
pin 2
pin 3
pin 4
pin 5
pin 6
pin 7
pin 8
pin 9
pin 10
pin 11
pin 12
pin 13
pin 14
pin 15

Accessory Connector

set point #1 relay, normally closed
set point #1 relay, common
set point #1 relay, normally open
set point #2 relay, normally closed
set point #2 relay, common
set point #2 relay, normally open
Tx, RS-232 signal out of the 908A; 9600-N-8-1
Rx, RS-232 signal into the 908A
ground, RS-232 and analog common
no function
CDG#2 buffered analog signal; 1Kohm output
no function
log analog output, 1Kohm output, 0.5 volts/decade
no function
CDG#1 buffered analog signal; 1Kohm output

Figure 9: 908A -- Accessory Connector Signals and Pins

G. Check Supply Voltage

The Model 908A incorporates a universal power supply. This allows the 908A to operate on any input voltage from 90 VAC to 240 VAC, 47 to 65 Hz.

H. Attach the Power Cord

Plug the power cord into the receptacle in the power module on the rear of the 908A.

IV Operation

A. Turn Power On

Plug the AC power end of the power cord into an electrical outlet. The loudspeaker will “beep” and test all indicators while the controller executes its self test. After being turned on, the instrument will go through the following sequence:

- “beeper”
- indicators for TORR, MTORR, MBAR, MBAR, PASCAL, KPASCAL, GAGE 1, GAGE 2
- 10 LED indicators for set points and other functions
- all four digits will light, including decimal points
- display shows the model number of the instrument, **908A**
- display shows software version, e.g. **1.10**

The 908A will go into normal operation and begin measuring pressure. If the CDG is not connected, the display will show **OFF**. If the system pressure is between 100% and 105% of the CDG Full Scale Range the display will flash, if the pressure is greater than 105% of the CDG Full Scale Range the display will show **OFF**.

B. Front Panel Controls

The Model 908A allows flexible configuration of operation using simple entry from the front panel buttons labeled GAUGE SELECT, SELECT, RAISE and LOWER. Parameters which you may adjust are selected by scrolling through list which begins with SET PT 1 HIGH. Each time the SELECT button is pushed, the led indicator advances to the next parameter. The LED indicators will be lit to indicate which parameter is being adjusted, and the digital display will flash to indicate the value of the parameter being adjusted.

Each push of a button will give a short “beep” from the loudspeaker to confirm the button was pushed. If you have reached the limit of adjustment or if the button push is not allowed, the loudspeaker will give a long “beep”.

Following is a detailed description of parameter selection and adjustment:

C. Set Pt 1 High

Default Value: OFF

This sets the high limit of the set point. Above this pressure, the set point relay will be de-energized. Press the RAISE or LOWER buttons to enter the value desired. The minimum value is OFF; this shuts the set point off. The next increment is 0.2% of the full scale range; for example, if the full scale range is 1 torr, the increment sequence is: OFF, 2.0 mTorr, 3.0 mTorr, etc.

When the RAISE or LOWER buttons are pressed, the display will change slowly at first. If you hold the button down for a few seconds, the rate of change will increase to allow you to make large changes more quickly.

SET PT 1 HIGH operates in conjunction with SET PT 1 LOW. While the 908A is in this mode, the set point may be assigned to either GAGE 1 or GAGE 2 by pressing the GAUGE SELECT button.

D. Set Pt 1 low

Default Value: OFF

This sets the low limit of the set point. This is the pressure at which the set point relay will be energized. Operation is similar to that of SET PT 1 HIGH above. The minimum value is OFF; this shuts the set point off. The next increment is 0.1% of the full scale range; for example, if the full scale range is 1 torr, the increment sequence is: OFF, 1.0 mTorr, 2.0 mTorr, etc.

SET PT 1 LOW operates in conjunction with SET PT 1 HIGH.

NOTE: The High and Low set point allow the user to set the hysteresis of the set point operation. As the system is pumped down, the set point relay will be energized (set point turns on) as the pressure drops below SET PT 1 LOW. The relay will remain energized until the pressure rises above SET PT 1 HIGH.

It is not possible to adjust the High set point to be lower than the Low set point. If you adjust the High set point below the pressure previously selected for the Low set point, the 908A will automatically reduce the value for the Low set point so that it is the next increment lower than that of the High set point.

E. Set Pt 2 High

Default Value: OFF

This operates in the same manner as SET PT 1 HIGH, described above.

F. Set Pt 2 Low

Default Value: OFF

This operates in the same manner as SET PT 1 LOW, described above.

G. Units mTorr/Torr/kTorr -- Bar/mBar/microBar -- Pascal/kPascal -- Arb

Default Value: Torr

This allows selection of the units to be used in display of the pressure. Press either the RAISE or LOWER buttons to alternate between Torr, mBar and Pascal. You will notice that both the GAGE 1 and GAGE 2 indicators will be lit also. This is to let you know that the units of measure apply to both gauges; it is not possible to select Torr for one gauge and mBar for the other gauge. The "Arb" value allows arbitrary units to be used; the value displayed is the same as for Torr units, and can be adjusted using the "Full Scale" and "Calibrate" functions.

H. Calibrate

Default Value: 1.00 (Internal value)

This allows the user to modify the reading for either gauge by multiplying by a value between 0.500 and 2.000. This is convenient for calibration of the CDG. CDGs are calibrated by the manufacturer before shipment; we suggest you use this adjustment only if you have reliable calibration data. The multiplier is internal, and is not seen by the user. The digital display shows the result of the pressure multiplied by the internal multiplier.

This adjustment may also be used to set the display to some value which is unique to your application or experiment.

NOTE

This adjustment is applicable to either gauge; please select the appropriate gauge by pressing GAUGE SELECT until the desired gauge is indicated. Use RAISE and LOWER as described above to set to the desired value.

The CALIBRATE function may be adjusted only when the CDG pressure is at 50% of full scale or higher.

NOTE — ATMOSPHERIC PRESSURE

You can use this function to set the atmospheric pressure reading for 1000 Torr CDGs. You should know the local barometric pressure before proceeding; your local airport or on the internet at www.weather.com may have this information. Normal barometric pressure is approximately 760 Torr (1000 mBar) at sea level and decreases by approximately 1 torr of every 47 feet above sea level.

I. Full Scale

Default Value: 1.00 Torr

This adjustment is applicable to either gauge; please select the gauge by pressing GAUGE SELECT until the desired gauge is indicated. Use RAISE and LOWER as described above to set to the desired value.

This allows the user to select the full scale range for each CDG. Press RAISE or LOWER to set the desired full scale range. The full scale ranges available are 20 mTorr, 50 mTorr, 100 mTorr, 1 Torr, 2 Torr, 10 Torr, 100 Torr, 1000 Torr, 5000 Torr and 10,000 Torr.

J. Zero

Default Value: 0.0 (internal value)

This allows the user to adjust the zero for each CDG. Before making this adjustment, the CDG should be connected to a vacuum system at a pressure lower than 0.01% of the full scale for the CDG. This adjustment may also be used to set the display to a specific value if you know the pressure through other means. For example, if the CDG to be adjusted is attached to a system that has another CDG which has been independently calibrated, the CDG may be made to read the same as the calibrated gauge.

The ZERO function may be adjusted only when the CDG pressure is at 10% of full scale or lower.

NOTE: INITIAL ZERO

When using installing a CDG for the first time, it is good practice to reset the 908A internal settings. This will prevent errors in set up, e.g. if the CDG has not had its internal zero properly adjusted. To reset the 908A, see **Reset of Stored Values**, just below. To adjust the zero, the vacuum system to which the CDG is connected should be at a pressure lower than 0.001 times the full scale range of the CDG. For example for a 10 Torr CDG, the system should be at a pressure lower than 0.01 torr, or 10^{-2} torr.

Adjust the zero adjustment on the CDG (usually a trimpot) until the 908A display shows a value close to zero. After this initial adjustment, the display may be conveniently be set to zero using front panel controls on the Model 908A.

NOTE: HEATED CDGs

When using heated or temperature-controlled CDGs, you should wait for an hour or two before making any adjustments to the 908A or the CDG. This will allow the CDG to come to its regulated temperature. When you are confident the CDG is at a stable temperature, adjust the zero adjustment on the CDG until the 908A display shows a value close to zero.

K. Reset of Stored (Default) Values

This allows you to recover the factory (default) settings for all stored values and resets the SET POINTS to off. For a system that is far out of calibration, the factory settings provide a good starting point for re-calibrating or adjusting the gauge controller. To recover the factory settings, unplug the 908A from its power source. Press and hold RAISE and LOWER buttons at the same time; while holding the RAISE and LOWER buttons depressed, plug the power cord in. You will hear a few short 'chirps' from the loudspeaker confirming the factory settings have been entered. The digital display will show RST to confirm the reset has been entered.

L. Set Point Operation

When pressure values have been entered for a set point (1 or 2) and assigned to a gauge (1 or 2), the set point relay operates as follows:

As the pressure on the assigned gauge falls through the chosen “Set Point N Low” pressure, the relay actuates, either opening (if the Normally Closed pin has been used on the Auxiliary I/O connector) or closing (if the Normally Open pin has been used on the Auxiliary I/O connector).

Likewise, as the pressure on the assigned gauge rises through the chosen “Set Point N High” pressure, the relay de-actuates, either closing (if the Normally Closed pin has been used on the Auxiliary I/O connector) or opening (if the Normally Open pin has been used on the Auxiliary I/O connector).

Protective Circuits for connecting loads to Terranova 9XX Set Point Relays

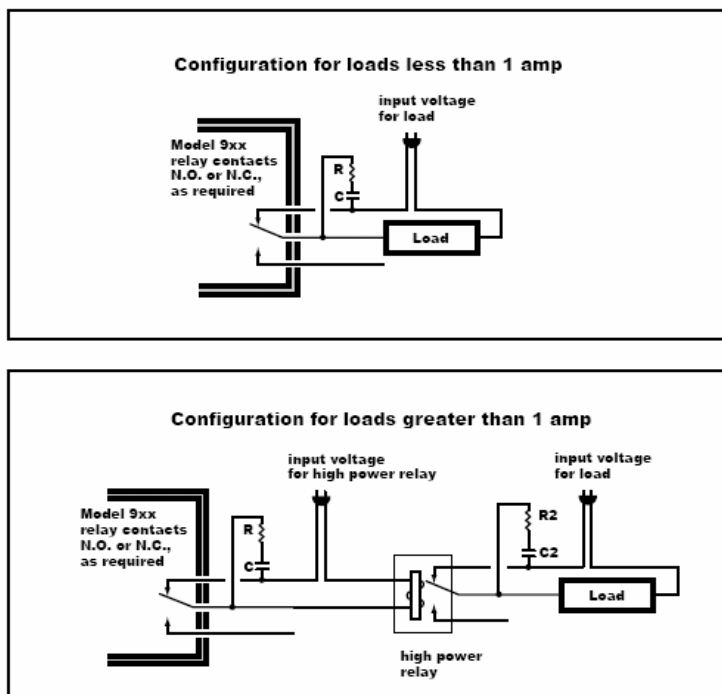


Figure 10: Protective Circuits for Connecting Loads to Set Point Relays

Snubber equations courtesy of CDE

$C = \frac{I^2}{10}$ $R = \frac{E}{10 \cdot I \left(1 + \frac{50}{E}\right)}$ <p>Where: C = capacitance, in uF I = load current in amperes prior to contact opening R = resistance in series with capacitor, in ohms E = source voltage</p>
--

**For 1 amp load and 110 VAC, C and R calculate to:
 C=0.1 uF and R=6 ohm (use 10 ohm)**

**For 0.1 amp and 110 VAC...
 C=0.001 uF and R=60 ohm (use 100 ohm)**

Common practice is to use 0.01 and 100 ohm for many types of load. These values are intended as guidelines only; your application may require experimentation to determine the best values of R and C or use of other snubber configurations.

Be certain to select C with a voltage rating equal to or greater than the input voltage. R is typically 1/2 watt rating for most applications.

**For additional information visit the paper by Tyco Relays (formerly Potter & Brumfield):
http://www.pandbrelys.com/app_pdfs/13c3311.pdf**

Figure 11: Choosing Component Values for Set-Point Protective Circuits

M. Reading Pressure

Pressure display and ranging are automatic in the 908A. Most readings will take place between zero pressure and the full scale of the 908A. The following table will help explain operation:

<u>Sensor Range Full-Scale</u>	<u>908A Lowest Scale</u>	<u>908A Highest Scale</u>	<u>Highest Display Resolution</u>	<u>Lowest Recommended Reliable Value</u>	<u>Lowest Set Point</u>	<u>Highest Set Point</u>
10 ktorr	X torr	XXE3 torr	1 torr	5 torr	50 torr	9990 torr
1000 torr	X.X torr	XXXX torr	0.1 torr	0.5 torr	5 torr	999.0 torr
100 torr	X.XX torr	XXX.X torr	0.01 torr	50 mtorr	0.50 torr	99.90 torr
20 torr	X.XXX torr	XX.XX torr	1 mtorr	10 mtorr	100 mtorr	19.98 torr
10 torr	X.XXX torr	XX.XX torr	1 mtorr	5 mtorr	50 mtorr	9.990 torr
2 torr	X.X mtorr	X.XXX torr	0.1 mtorr	1 mtorr	10 mtorr	1.998 torr
1 torr	X.X mtorr	X.XXX torr	0.1 mtorr	0.5 mtorr	5 mtorr	999.0 mtorr
100 mtorr	X.XX mtorr	XX.XX mtorr	0.01 mtorr	0.05 mtorr	0.5 mtorr	99.90 mtorr
50 mtorr	X.XX mtorr	XX.XX mtorr	0.01 mtorr	0.025 mtorr	0.25 mtorr	49.95 mtorr
20 mtorr	X.XX mtorr	XX.XX mtorr	0.01 mtorr	0.01 mtorr	0.1 mtorr	19.90 mtorr

Notes:

1. From 100% of full scale to approximately 130% of full scale, the display will flash.
2. Above approximately 130% of full scale, the display will indicate “HI”.
3. Prior to proper setting of zero, the display may show a negative value, as low as -1% of full scale. Of course negative readings are meaningless, but only provide span for adjustment. Below approximately -1% of full scale, the display will indicate “LO”. Proper adjustment of the 908A zero and sensor zero will move readings out of the negative range.

Figure 12: 908A Ranges: Sensor, High, Low, Set Points

N. Analog Output

The analog output is calculated from the value of the digital display and for the gauge selected. The output is logarithmic, 0.5 volt/decade; the source impedance for the output is 1 K ohm. The output voltage is calculated from:

$$V=0.50*(\log_{10}(100*Pressure))$$

where V is the Analog Output in volts; P is the pressure in mTorr or μbar. Some examples follow; because of normal tolerances in the electronics, there may be minor differences in the values you observe compared to those shown:

<u>Displayed pressure</u>	<u>Analog Output - volts</u>
LO	0.00
0 mTorr (μBar) or less	0.00
0.016 mTorr (μBar)	0.10
0.10 mTorr (μBar)	0.50
0.20 mTorr (μBar)	0.65
1.0 mTorr (μBar)	1.00
1.58 mTorr (μBar)	1.10
10.0 mTorr (μBar)	1.50
100 mTorr (μBar)	2.00
1.00 torr (mBar)	2.50
10.0 Torr (μBar)	3.00
100 Torr (mBar)	3.50
999 Torr (mBar)	4.00
10.00 kTorr (mBar)	4.50
OFF or HI	5.00

Figure 13: Analog Output and Displayed Pressure

The pressure as a function of the Analog Output voltage is:

$$P=0.01*\log^{-1}(2V) \quad \text{or}$$

$$P=0.01*10^{(2V)}$$

NOTE:

The analog output is valid for the gauge which is selected on the display.

O. Serial Interface

The RS-232 serial port gives pressure readings when requested by the terminal. The interface is standard RS-232 format; 9600 baud, 8-bits, no parity, 1 stop bit. The interface is through the 15-pin D-sub accessory connector, see Figure 8, page 12.

pin 7 is Tx (signal from the 908A to the terminal)
 pin 8 is Rx (signal from the terminal to the 908A)
 pin 9 is return (ground).

The serial port allows reading pressure and other parameters of the 908A; it is not possible to modify stored parameters over the serial port.

Serial Interface Cable: PC Serial Port to Terranova 9XX Products

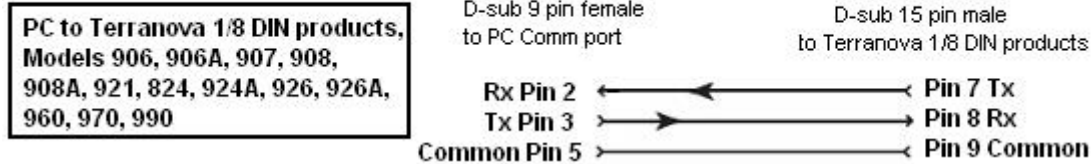


Figure 14: Serial Interface Cables from PC to Terranova 908A

The following commands are used in the 908A:

1. Pressure

To read the pressure of both gauges

Send “p” (ASCII value 112); the 908A sends pressure for gauge 1 and gauge 2 to the terminal. Output is in the format:

ABCDeE FGHIeJ

where

ABCD is the multiplier and *E* is the exponent for CDG #1

FGHI is the multiplier and *J* is the exponent for CDG #2

Some examples follow:

<u>Displayed Pressure</u>	<u>Serial Output</u>
OFF	Off
LO	Low
0.000 mTorr	0.000e-3
0.800 mTorr	0.800e-3
2.800 mTorr	2.800e-3
-1.600 mTorr	-1.600e-3
57.10 mTorr	57.10e-3
2.340 torr	2.340e+0
105.0 torr	105.0e+0
4115 torr	4115e+0
HI	9999e+0

Figure 15: Serial Output and Displayed Pressure

Since both gauges are maintained in an active state, pressure data taken over the serial port are valid for both gauges at the same time, regardless of which gauge is shown on the digital display.

2. Full Scale Of The Gauges

To read the full scale range selected during set up for each gauge

Send “f” (ASCII value 102); the 908A returns full scale which the user has selected for each gauge in the format:

JKLM_eN OPQR_eS

where

JKLM is the multiplier and *N* is the exponent for CDG #1

OPQR is the multiplier and *S* is the exponent for CDG #2

Some examples follow:

<u>Full Scale</u>	<u>Serial Output</u>
50 mTorr	50.00e-3
100 mTorr	100.0e-3
1 Torr	1.000e+0
100 Torr	100.0e+0
1000 Torr	1000e+0
10000 Torr	10.00e+3

Figure 16: Serial Output and Full Scale Range Setting

3. Units Of Measurement

To read the chosen units of measure (both gauges), Send “u” (ASCII value 117); the 908A returns

Torr
or
mBar
or
Pascal
or
Arb

4. Set Point #1

To read the setting and status of set point #1

Send “1” (ASCII value 49); the 908A returns information for set point #1 in the format:

STUVeW XYZAeBC D

where:

STUV is the multiplier and *W* is the exponent for set point #1 high

XYZA is the multiplier and *B* is the exponent for set point #1 low

C is set point relay status; 0= relay is not energized, 1=relay is energized

D is the gauge to which the set point #1 has been assigned: either 1 or 2

5. Set Point #2

To read the setting and status of set point #2

Send “2” (ASCII value 50); the 908A returns information for set point #2 in the same format as for set point #1, above.

6. Model And Software Revision

To read software identification.

Send “v” (ASCII value 118); the 908A returns the model number of the instrument and the revision number, as in the following example:

908A ver 1.10

P. Pascal/kPascal Pressure Units Only Set-Up (-J Mode)

The Terranova 908A has a special -J Mode, where only Pascal/kPascal units are available for display. In this mode, during the SELECT process, the UNITS will not permit changing to Torr/mTorr or mBar/microBar. This mode is intended for use in the Japanese market and elsewhere if choice of units is not allowed.

To enter the -J mode, unplug the 908A from its power source. Press and hold all three RAISE, LOWER and SELECT buttons at the same time; while holding the THREE buttons depressed, plug the power cord in. Maintain the depression of three buttons for a few second until the -J mode has been set up. The digital display will show, in the revision number sequence **N.NNJ**, to confirm the reset has been entered.

The unit will not return to normal operation for a normal RESET operation. To exit the -J mode, repeat the process shown above: To exit the -J mode, unplug the 908A from its power source. Press and hold all three RAISE, LOWER and SELECT buttons at the same time; while holding the THREE buttons depressed, plug the power cord in. Maintain the depression of three buttons for a few second until -J mode has been exited. The digital display will then show, in the revision number sequence **N.NN**, to confirm the reset has been entered. At this point, the “units” choice can made using SELECT, RAISE and LOWER buttons

Terranova 908A-J					
CDG Full Scale Range				Digital Display	
mTorr/Torr		Pascal/kPascal		Low Range	High Range
20	mTorr	2.66	Pa	0.000 to 2.660	
50	mTorr	6.65	Pa	0.000 to 6.650	
100	mTorr	13.3	Pa	0.000 to 9.999	10.00 to 13.30
1	Torr	133	Pa	0.00 to 99.99	100.0 to 133.0
2	Torr	266	Pa	0.00 to 99.99	100.0 to 266.0
5	Torr	665	Pa	0.00 to 99.99	100.0 to 665.0
10	Torr	1330	Pa	0.0 to 999.9	1000 to 1330
20	Torr	2660	Pa	0.0 to 999.9	1000 to 2660
50	Torr	6650	Pa	0.0 to 999.9	1000 to 6650
100	Torr	13.3	kPa	0 to 9999 Pa	10.00 to 13.30 kPa
200	Torr	26.6	kPa	0 to 9999 Pa	10.00 to 26.60 kPa
500	Torr	66.5	kPa	0 to 9999 Pa	10.00 to 66.50 kPa
1000	Torr	133	kPa	0.00 to 99.99	100.0 to 133.0
2000	Torr	266	kPa	0.00 to 99.99	100.0 to 266.0
5000	Torr	665	kPa	0.00 to 99.99	100.0 to 665.0

Figure 17: Torr-Pascal Relationship Terranova 908J

V Maintenance

A. Changing Fuses

The controller contains two fuses. Both fuses are held in the fuse assembly that is part of the power module located on the back panel of the controller. To change fuses, unplug the line cord from the power entry module at the rear of the 906; locate the fuse block immediately below the line cord socket. Press the tab of the fuse assembly and withdraw the fuse assembly from the power module.

Turn the fuse assembly around so that the fuses are facing you. Check both fuses; replace the burnt-out fuse with a fuse of the appropriate rating (refer to **Specifications** section). Reinsert the fuse assembly into the power module; push it in until the ears click into place.

Replacement fuse type: 5 mm X 20 mm, regular or slow-blow 1 amp

<u>manufacturer</u>	<u>fuse type</u>
Bussman	GDB-1A or GDC-1A
Littlefuse	217 001 or 218 001

B. Schematic Diagrams

Because of the proprietary nature of our products, we do not supply schematic diagrams or software listings. If you have any problem with operation or interface to any of our products, please contact us; we will do everything we can to serve your needs.

VI Troubleshooting

Error Codes: Under the stated conditions, Error Codes are shown on the display:

- 01 = Action Not Allowed at This Time
- 02 = Parameter Exceeds Limit of Adjustment
- 03 = A Timeout Occurred during Adjustment
- 05 = Attempt To Change Units While Pascal Lock Engaged
- 21 = CDG Zero Adjustment Not Allowed at This Pressure
- 22 = CDG Atmosphere Adjust Not Allowed at This Pressure

Figure 18: Error Codes

Self Test: If the self-test fails, run the self-test again by turning the power off and then on again. The following sequence should be executed:

- “beeper”
- indicators for TORR, MTORR, MBAR, MBAR, PASCAL, KPASCAL, GAGE 1, GAGE 2
- 10 LED indicators for set points and other functions
- all four digits will light, including decimal points
- display shows the model number of the instrument, **908A**
- display shows software version, e.g. **1.10**

If it fails again, call Duniway Stockroom.

Fuses: If fuses burn out, check to see that the proper voltage has been supplied to the power input module. If fuses burn out repeatedly call Duniway Stockroom.

Display Shows -LO, OFF or HI: If the digital display consistently shows -LO, OFF or HI, it may be that one of the internal power supply protection devices has removed power to the CDG. You may check this by measuring the voltage at the connector or cable for the unaffected gauge. Since power for both gauges use the same protection device, either connector will show the power supply voltages. Normal range for the voltages are 14.5 to 15.5 volts for both +15 volts and -15 volts. +15 may be measured on the red wire; -15 is on the green wire; power return is on the black wire. If the power supply protection has shut the power off, you will typically measure less than 4 volts on the affected supply.

If you verify that either power supply is shut off, remove power from the CDG for a few minutes to allow the protection device to reset itself. The protection device does not need to be replaced; it is a reusable thermal fuse.

You may wish to determine the cause for the loss of power supply voltage before applying power again. The 908A will protect itself if it finds excessive power draw again.

It is normal for the 908A to feel warm to touch along the left side of the case. This is especially true when operating heated CDGs because of the greater power they require.

VII Return Procedure

If you need to return the gauge controller to Terranova for service:

- Contact Duniway Stockroom to get a **RMA** (Return Material Authorization) number.
- Then pack the instrument securely.
- Use the original packaging if it is available.
- If the Terranova 908A was shipped with a cable and/or CDG sensor, diagnosis and repair will be more efficient if all components are returned together. If this is not convenient, please consult with your Duniway Stockroom Customer Service Representative
- If you do not have appropriate packing materials, a commercial packing and shipping firm can provide them.
- Be sure to mark the **RMA** number on the outside of the package.

VIII Warranty

Terranova products of Duniway Stockroom Corp. are warranted to be free of defects in material and workmanship for a period of one year from the date of shipment. At our option, we will repair or replace products which prove to be defective during the warranty period. Liability under this warranty is limited to repair or replacement of the defective items. Shipping damage is excluded from the scope of this warranty. Gauge tubes of all types are excluded from this warranty.

Terranova products are warranted not to fail to execute programming instructions due to defects in materials and workmanship. If Duniway Stockroom receives notice of such defects during the warranty period, Duniway Stockroom will repair or replace firmware that does not execute its programming instruction due to such defects. Duniway Stockroom does not warrant that the operation of the firmware or hardware will be uninterrupted or error-free.

If this product is returned to Duniway Stockroom for warranty service, Buyer will pre-pay shipping charges and will pay all duties and taxes for products returned to Duniway Stockroom. Duniway Stockroom will pay for return of products to Buyer, except for products returned to a Buyer from a country other than the United States.

LIMITATION OF WARRANTY: *The foregoing warranty does not apply to the defects resulting from:*

- 1. Improper or inadequate maintenance by Buyer;*
- 2. Buyer-supplied interfacing;*
- 3. Unauthorized modification or misuse;*
- 4. Operation outside of the environmental specifications of the product; or*
- 5. Improper site preparation and maintenance.*

THE WARRANTY SET FORTH ABOVE IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. DUNIWAY STOCKROOM DISCLAIMS ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES: *The remedies provided herein are Buyer's sole and exclusive remedies. In no event will Duniway Stockroom be liable for direct, indirect, special, incidental, or consequential damages, including loss of profits, whether based on contract, tort, or any other legal theory.*

DECLARATION OF CONFORMITY

We, Duniway Stockroom Corp., declare under our sole responsibility, that the following products, displaying the CE mark on the rear panel:

Model 908A Dual Capacitance Diaphragm Gauge Controller

to which this declaration relates, are in conformity with the following standards or normal documents

EMC Directive (89/336/EEC//93/68/EEC)
Electromagnetic Compatibility
Standards: EN 50081-1 & 2: 1992, EN 50082-1 & 2: 1993

CENELEC EN61326
Electrical Equipment for Measurement Control and Laboratory Use
EMC Requirements Part 1: General Requirements
IEC 61326; 1997 + A1: 1998

Low Voltage Directive (73/23/EEC//93/68/EEC)
Electrical/Technical Safety
Standard: EN 61010-1: 1993/A2: 1995



following the provisions of the EMC directive (89/336/EEC)

UL3101-1
UL Standard for Safety
Electrical Equipment for Laboratory Use
Part 1: General Requirements



January 3, 2002

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by: Sherman Rutherford
Compliance Manager

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