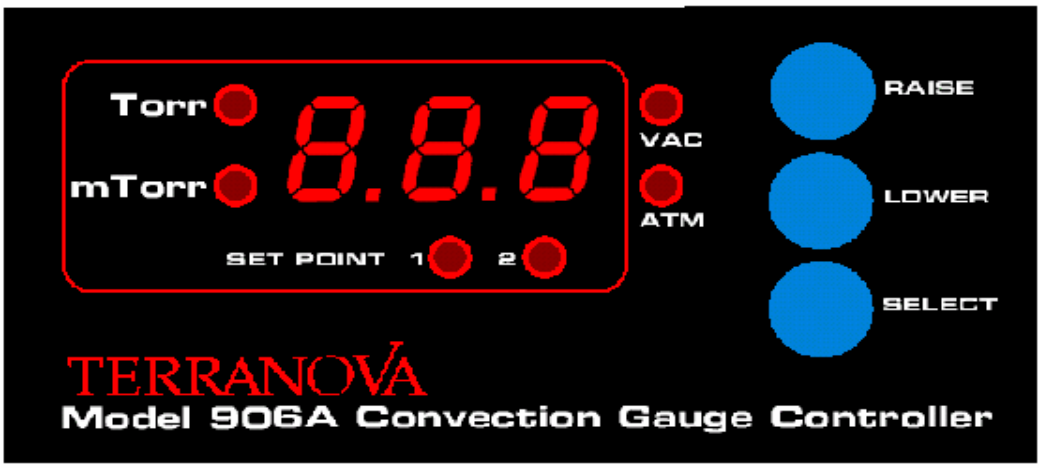
Instruction Manual

Terranova

Model 906A Convection Gauge Controller

for use with a 275 CONVECTRON® or MKS/HPS 317 CEP tube



DUNIWAY STOCKROOM CORP.

rev082813sr

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Explosive Gases

WARNING!
Do not use the Model 906A Convection 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 can raise the gauge above the ignition temperature 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.

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II Front Panel, Rear Panel & Dimensions

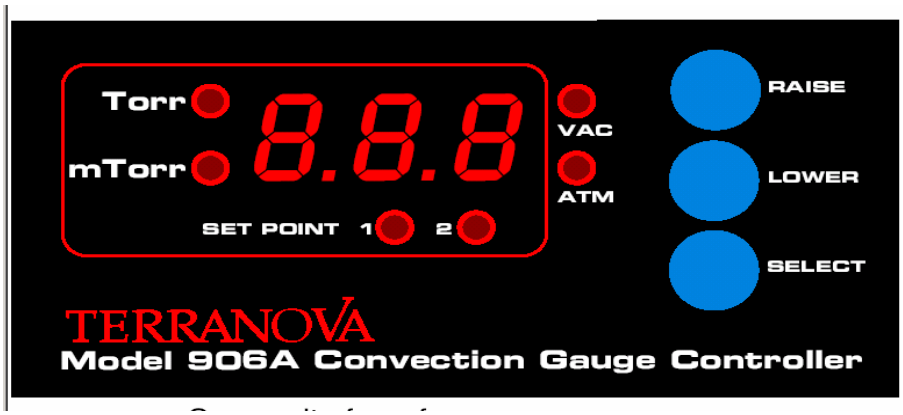

Figure 1: Model 906A: front view

Dimensions – standard 1/8 DIN enclosure

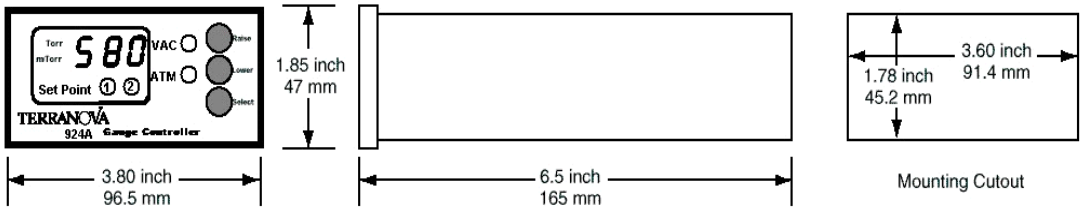

Figure 2: Model 906A: dimensions

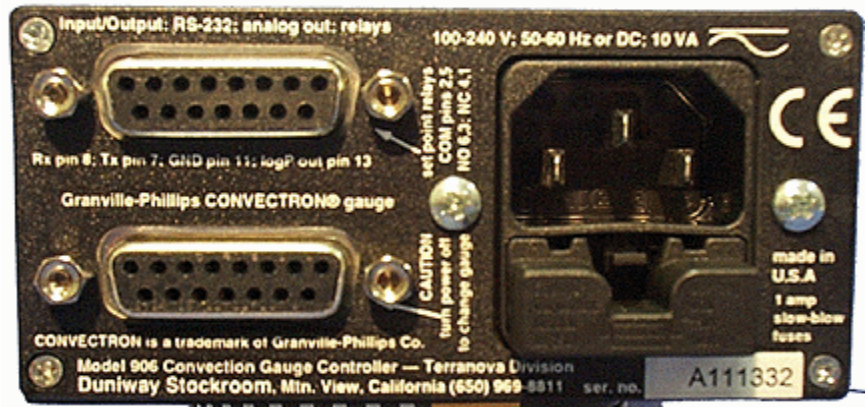

Figure 3: Model 906A: rear view

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III Overview

A. General Description

The Terranova Scientific Model 906A Convection Gauge Controller displays vacuum pressure as measured from an HPS Model 317 Convection Enhanced Pirani (CEP) or Granville-Phillips Model 275 CONVECTRON® gauge tube. It displays vacuum measurements based on thermal conductivity of air/nitrogen or argon. The Model 906A controller covers the range from 0.1 mTorr to 1000 Torr or 0.1 µbar to 1000 mbar, and controls two relays with independent set points.

B. Specifications

1. Useful Measuring Range

   0.1 mTorr (µbar) to 995 Torr (mbar), for air or nitrogen; (10^{-4} torr (mbar) to 10^{3} torr (mbar)); range selection is automatic

2. Display Range

   -19 mTorr (µbar) to 995 torr (mbar); pressures lower than -19 mTorr (µbar) display ***LO***; pressures higher than 995 torr (mbar) display ***HI***; if cable is not plugged in display shows ***OFF***

3. Accuracy of Interface to Gauge

   Pressure calculation algorithm is accurate to ±1% of published data for the HPS Convection Enhanced Pirani and the Granville-Phillips CONVECTRON® gauge (this is for the 906A controller only, and does not include uncertainty of the gauge).

4. Units of Display

   torr/mtorr or Bar/mBar; must be specified at time of ordering (see Section V-H for changing Units of Display in the field)

5. Vacuum Gauge

   HPS Convection Enhanced Pirani gauge, series 317 or Granville-Phillips CONVECTRON® gauge, series 275

6. Operating Temperature Range

   +2 to +50 deg. Celsius

7. Pressure Display

   3-digit bright red LED, 10 mm high

8. Display Indicators

   bright red LED for VAC, ATM, SET PT 1, SET PT 2

9. Display Resolution

   varies; from 0.1 mTorr (µbar) below 10 mTorr (µbar), to 5 Torr (mbar) above 100 Torr (mbar)

10. VAC and ATM Adjust

    adjusted by front panel push-button

11. Process Control Set Points

    two, adjusted by front panel push-button

12. Process Control Relays

    two relays, 2 amp, 240 VAC contacts; independent Normally Open and Normally Closed; +5 volts is provided for TTL applications; available through the DB15 accessory connector

13. Nonvolatile Memory

    for VAC, ATM and SET POINTS

14. Analog Output

    calibrated, 12-bit resolution, logarithmic, 0.50 volts/decade; 0.0 mTorr (µbar) = 0 volts; 10 mTorr (µbar) = 0.50 volts; 100 mTorr (µbar)= 1.00 volts; etc.; available through the DB15 accessory connector

15. RS-232 Input/Output

    allows user to read pressure and set points; 9600 baud, 8-N-1; available through the DB15 accessory connector

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16. Operating Voltage

The Model 906A has a universal power supply, which operates on input voltages from 100 to 240 V 50/60 Hz or DC; standard IEC 320 power input receptacle on rear panel; replacement fuse type: 5 mm X 20 mm, regular, 1 amp

manufacturer	fuse type
Bussman	GDB-1A or GDC-1A
Littlefuse	217 001 or 218 001

17. Weight

1 lb. / 0.5 kg

18. Mounting

Side clips are provided for panel mounting in standard 1/8 DIN cutout.

19. Environmental Considerations

not for use with explosive or corrosive gases

20. Vacuum Gauge Tubes

are available from the following sources:

Duniway Stockroom Corp.
48501 Milmont Drive
Fremont, CA 94538
Telephone (800) 446-8811 or
(650) 969-8811 FAX (650) 965-0764

HPS Division, MKS Instruments, Inc.
5530 Sterling Drive
Boulder, Colorado 80301
Telephone (800) 367-1967 or (303) 449-9861
Facsimile (303) 442-6880

Granville-Phillips Company
5675 Arapahoe Avenue
Boulder, Colorado 80303
Telephone (800) 776-6543 or (303) 443-7660
Facsimile (303) 443-2546

IV Installation

A. Unpack the Controller

Carefully unpack the Model 906A Convection Gauge Controller.
The shipment includes these components:

- controller unit
- power cord
- mounting clips
- DB15 accessory connector
- this instruction manual

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

B. Mount the Controller

You can mount the controller unit freestanding 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 44 mm by 92 mm. 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 until the central tongue locks the clip in place. Then slide the unit into the panel; the clips will hold the unit in place.

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

C. Select the Gauge Tube

The Model 906A controller is designed to work with the Granville-Phillips CONVECTRON®, series 275 or HPS/MKS Enhanced Convection Pirani, series 317 tubes. If you have difficulty obtaining a gauge, please contact us at Duniway Stockroom.

CAUTION

Use of a gauge tube other than those listed above may cause improper readings, and may cause damage to the gauge tube.

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D. Connect the Gauge Tube

Make sure that the gauge tube is securely connected to the vacuum system, using good vacuum practice. The gauge tube must be mounted with its axis horizontal, and the port pointing down; large errors may result at higher pressures if the gauge axis is not horizontal.

E. Attach the Gauge Cable

The gauge cable has a special connector for the gauge on one end and a 15-pin DB connector on the other. Be sure to use the cable supplied with the Model 906A.

CAUTION

Make sure that the power to the controller unit is off before you connect the gauge tube to the controller unit. Unplugging and then plugging in the gauge cable with the power on can cause the gauge to burn out.

Connect the gauge cable to the gauge tube. Align the keyway of the connector with the key on the gauge tube, and push the connector onto the gauge tube's pins until it seats firmly.

Connect the 15-pin DB plug of the gauge cable to the 15-pin DB jack on the back of the controller unit. Push the plug onto the jack until it is firmly in place. Tighten the retaining screws to make certain the connector remains in place. Loose connections can damage the gauge.

NOTE

If you have a cable from one of the analog display Granville-Phillips CONVECTRON® gauge controllers, it is an easy task to convert the cable for use with the Model 906A. The analog controller uses a combination cable for the CONVECTRON® gauge and for AC power input. To convert the cable:

- You must have a DB15 connector with male pins; a connector with solder cups is an easy version to work with. If you have difficulty locating one of these, call us and we will send you one.
- Identify the cable which plugs into the CONVECTRON® gauge.
- Follow the cable to the edge-connector and cut the cable, separating the cable from the edge-connector.
- Remove the jacket of the cable, about 1.5 inch (40 mm).
- Strip the wires, about 0.25 inch (0.5 mm).
- Observe the pin numbers identified on the CONVECTRON® gauge connector and the DB15 connector.
- Connect as follows (Granville-Phillips colors are shown, but you should verify the connections with a continuity checker): see next page.

Terranova 906A D-15 pins	275 CONVECTRON® gauge connector pin	CEP HPS/MKS 317 D-9 pins
8	1	1,3 & 6
7	1	1,3 & 6
6	5	8
5	2	7
4	3	2,4,5 & 9
3	3	2,4,5 & 9
2	shield	2,4,5 & 9
no connection	4	

Figure 4: Terranova 906A 15-D to 275 or CEP Connector

F. Make Relay Connections

You can set two process control set points from the front panel of the controller (SET PT 1) and SET PT 2). The set points control two relays that are accessible through the connector on the back of the controller. SET PT 1 controls relay #1, and SET PT 2 controls relay #2. Relay contacts are available through the DB15 Accessory Connector.
NOTE: See also Section VIII - Application Note - Protective Circuits for Set Point Relays

G. Accessory Connector

The Accessory Connector is the top DB15 connector on the rear panel of the 906A. The connector has female pins, the mating connector must have male pins. If you need help identifying a connector source, please contact us. Following are pin assignments for the Accessory Connector:

Pin	Function
1	normally closed contact for set point relay 1
2	armature/wiper for set point relay 1
3	normally open contact for set point relay 1
4	normally closed contact for set point relay 2
5	armature/wiper for set point relay 2
6	normally open contact for set point relay 2
7	Tx for RS-232 interface (see **Serial Interface**)
8	Rx for RS-232
9,10,11,14	ground, electronics common
12	+5 volts, supplied through 1K resistor, for TTL use
13	analog output, 0.5 volt/decade (see **Analog Output**)
15	CONVECTRON bridge output; 10K source resistance

Figure 5: Accessory Connector Pin Assignments

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H. Check Voltage Setting

The Model 906A incorporates a universal power supply. This allows the 906A to operate on any input voltage from 85 VAC to 240 VAC, 50/60 Hz. Earlier versions of the 906A, with serial number lower than 2310 are not of this universal design. If you are in doubt as whether your 906A is universal input, please check the 906A rear panel for the recommended input voltage.

I. Attach the Power Cord

Plug the power cord into the receptacle in the power module. Plug the other end of the power cord into an electrical outlet.

V Operation

A. Turn Power On

The loudspeaker will "beep" and all indicators will light for a few seconds while the controller executes its self test. After the self-test, the display will show:

- the model number, e.g. **906**,
- the software version, e.g. **1.20** for a second;
- then it will display the units of measure, torr or mbar, e.g. **TOR** or **BAR** for one second
- then the sensor curve chosen, **275** or **CEP**.

The 906A will then begin measuring pressure. If the gauge cable is not connected, the display will show **OFF**. If the system pressure is greater than 990 Torr (mbar) or if the gauge is disconnected from the cable, the display will show **HI.**

B. Choice of Model 317 HPS/MKS CEP or Model 275 Convectron® Response Curves

Default: G-P Model 275 Convectron® ("275")

The "CEP" tube and the "275" tube have slightly different response curves over the 7 decades of pressure indication. In order to provide the most accurate pressure indication, the user is offered the choice of response curves, depending on the sensor tube chosen.

To change from "275" to "CEP" response curves, unplug the 906A from its power source. Press and hold RAISE and SELECT buttons at the same time; while holding the RAISE and SELECT buttons depressed, plug the power cord in. You will hear a two short 'chirps' from the loudspeaker confirming the response curve has been changed. The digital display will show **CEP** to confirm the reset has been entered. This process can be reversed by following the same procedure. The unit will be returned to the 275 response curve during Reset of Stored (Default) Values.

C. Calibration

You can set the zero point of the display or calibrate it to atmospheric pressure; in addition, you can recover the factory settings. These calibrations use the SELECT, RAISE and LOWER buttons.

D. Setting to Zero

The system pressure should be lees than 1 mTorr (1μbar).
Press the button labeled SELECT. You will hear a short 'chirp' from the loudspeaker and the VAC LED will flash; you may now use RAISE and LOWER to set the pressure to zero. The actual pressure must be less than approx. 50 mTorr (65 μbar); if you try to set zero pressure when the instrument is greater than 50 mTorr (65 μbar), you will get a long beep from the loudspeaker.

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E. Setting Near Zero

The display may be set to a specific value near zero. For example, if you know that the system pressure is 10 mTorr (10 µbar), you can set the display to agree with this value, as follows: while in VAC adjust, press RAISE or LOWER to set to the desired value. If the system pressure is greater than approx. 50 mTorr (65 µbar), you cannot make these adjustments.

F. Setting Atmosphere

You should know the local barometric pressure before proceeding; your local airport may have this information. Normal pressure is approximately 760 Torr (1000 mbar) at sea level.

Press the button labeled SELECT until the ATM LED is flashing. You may now use RAISE and LOWER to set the pressure to the desired pressure. If you try to set ATM pressure when the pressure is less than approx. 200 torr (350 mbar), you will get a long beep from the loudspeaker. As the display changes, you will hear a series of 'chirps' from the loudspeaker.

G. Reset of Stored Values

This allows recovering the factory settings for VAC and ATM and resets SET POINTS to minimum: For a system that is far out of calibration, the factory settings provide a good starting point for recalibrating the gauge controller. This procedure also enters **OFF** for the set points. To recover the factory settings, unplug the 906A for its line voltage power source. Press and hold RAISE and LOWER buttons at the same time; plug the power cord in. You will hear a few short 'chirps' from the loudspeaker confirming the factory settings have been entered.

H. Changing Units of Measurement

This allows you to change from measurement in Torr to mBar or from mBar to Torr. The internal software allows the 906A to display pressure in either Torr or mBar. The 906A is shipped with the unit of measure which was specified at the time of the order. If you wish to change the units of measure, remove power form the 906A by unplugging it from the AC mains. Press and hold all three buttons, SELECT, RAISE and LOWER; plug the AC power in and wait for the two "chirps" from the loudspeaker to confirm the units change. After the display self-test, the display will show **TOR** or **BAR**, to confirm the selected units.

NOTE: Make certain that the labels on the front panel units (torr and mTorr; or µbar and mbar) match the selected units. If you need a different display overlay, please let us know. This procedure is a bit inconvenient, but it is not intended to be a function that is changed often.

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I. Set Point Operation

When the displayed system pressure is less than the value of the set points, the set point relay is turned on; the corresponding LED lights to indicate that the relay is energized. The relay will be turned off when the pressure rises to 5% above the set point, plus 1 mTorr. For example:
If the set point is 30 mTorr, the set point relay will turn on at 30 mTorr; it will turn off at [30 + 0.05*30 + 1]=32.5 mTorr, and higher pressures.

If the set point is 3 mTorr, the set point relay will turn on at 3 mTorr; it will turn off at [3 + 0.05*30 + 1]=4.0 mTorr, and higher pressures.

If the set point is 1 torr, the set point relay will turn on at 1.00 torr; it will turn off at [1.00 + 0.05*1.00 + 0.001]=1.05 torr, and higher pressures.

NOTE: See also Section VIII - Application Note - Protective Circuits for Set Point Relays

J. Reading the Set Points

To see the value of a set point, push the SELECT button until the desired SET PT LED is flashing.

K. Setting the Set Points

The range for the set point settings is from 3 mTorr (mbar) to 500 torr (mbar). The **OFF** setting disables the set point control and keeps the relays from operating. The **OFF** setting is the lowest setting, below 3 mTorr (μbar).

To set a set point, push the SELECT button until the desired SET PT LED is flashing. The display will indicate the current value of the set point. Use the RAISE and LOWER buttons to adjust the set point to the desired value. As the indication changes, you will hear short 'chirps' from the loud-speaker.

NOTE:
When using the SELECT button, the display will remain in the selected function until the SELECT button is pushed again; or if no button is pushed for 60 seconds, the instrument will revert to normal operation. This automatic reset is to prevent any error to process control if the instrument is left in the adjust mode.

L. Analog Output

The analog output is calculated from the value of the digital display. The output is logarithmic, 0.5 volt/decade; the source impedance for the output is 10 K ohm. The output voltage is calculated from:

$$V=0.500(\log_{10}P)$$

where V is the Analog Output in volts; P is the pressure in mtorr or μbar.

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

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

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

where P is pressure in mtorr or μbar; V is the Analog Output in volts.

Some examples follow; because of normal tolerances in the electronics, there may be minor differences in the values you observe compared to those shown:

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Displayed Pressure	Analog Output - volts
LO	0.000
0 mTorr (µbar) or less	0.000
10 mTorr (µbar)	0.500
20 mTorr (µbar)	0.651
100 mTorr (µbar	1.000
10 torr (mbar)	2.000
990 torr (mbar)	2.998
OFF or **HI**	3.000

Analog Output - volts	pressure- mtorr (µbar)
0.100	1.58
0.500	10.0
0.600	15.8
1.100	158
2.000	10,000

Figure 6: Analog Output Voltage vs. Pressure

M. Serial Interface

The serial port gives pressure readings when requested by the RS-232 terminal. The interface is standard RS-232 format; 9600 baud, 8-bits, no parity, 1 stop bit. The interface is through the DB15 accessory connector.

pin 7 is Tx (signal from terminal to the 906A)
pin 8 is Rx (response from the 906A to the terminal)
pin 9 is return (ground).

To get pressure readings, send a lower case "p" (ASCII value 112). Output is converted from the digital display, in the following format:

WXYeZ, where *WXY* is the multiplier and *Z* is the exponent; Some examples follow:

displayed pressure	Serial Output
OFF	-99e-3
LO	-20e-3
0.0 mTorr	0.0e-3
0.8 mTorr	0.8e-3
2.8 mTorr	2.8e-3
-1.6 mTorr	-1.6e-3
57.1 mTorr	57.1e-3
2.34 torr	2.34e+0
135 torr	135e+0
HI	999e+0

Figure 7: Serial RS-232 Output Vs. Pressure: Examples

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To read the stored Set Points, send a "1" (ASCII value 49) or "2" (ASCII value 50) to read Set Point 1 or Set Point 2. Output is in the same format as for pressure readings. An added digit shows whether the Set Point is active (system pressure is lower than the set point, and the set point relay is energized); this digit is "0" when the set point is not active (set point relay is off), and is "1" when the set point is active (set point relay is on).

To read the units of measure, send a lower case "u" (ASCII value 117); this returns "torr" or "mbar" depending on the units selected.

To read the type of Convection Gauge Selected: Send "x" (ASCII value 120); the 906A returns the type of convection sensor tube selected, either HPS/MKS CEP or Granville Phillips 275 Convectron®, as in the following example:

CEP or **275**

To read the Model Number and Revision Level: Send "v" (ASCII, value 118); the 906A returns "906 ver 1.20"

N. Serial RS-232 Cable for PC Computer

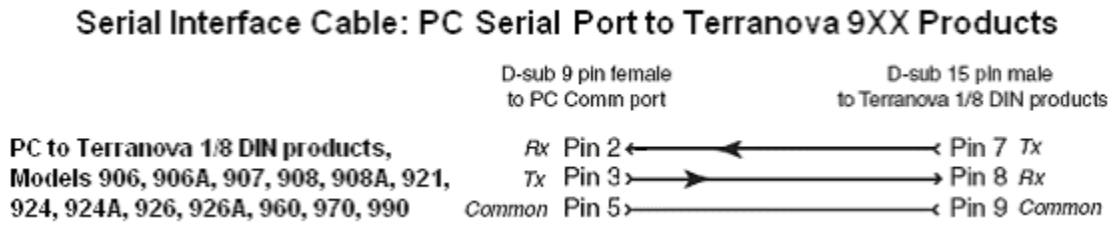

Figure 8: Serial RS-232 Cable for PC Computer

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O. Other Gases

If you need to measure the pressure of gases other than air or nitrogen, refer to the following table: (This data is for the AIR setting of the 906A)

Figure 9: Indicated pressure on Model 906A display, torr

True Pressure	Indicated Pressure									
torr	Argon	CO2	Deuterium	Freon 12	Freon 22	Helium	Krypton	Methane	Neon	Oxygen
0	0	0	0	0	0	0	0	0	0	0
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0002	0.0001	0.0001
0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0002	0.0002	0.0003	0.0001	0.0002
0.0005	0.0003	0.0006	0.0006	0.0008	0.0007	0.0004	0.0003	0.0008	0.0003	0.0005
0.001	0.0007	0.0011	0.0019	0.0015	0.0014	0.0008	0.0005	0.0018	0.0007	0.0010
0.002	0.0013	0.0023	0.0024	0.0030	0.0029	0.0016	0.0010	0.0032	0.0014	0.0020
0.005	0.0033	0.0055	0.0060	0.0075	0.0068	0.0040	0.0023	0.0077	0.0035	0.0049
0.01	0.0065	0.0109	0.0120	0.0147	0.0135	0.0080	0.0046	0.0152	0.0070	0.0097
0.02	0.014	0.022	0.024	0.030	0.027	0.016	0.009	0.031	0.014	0.020
0.05	0.033	0.055	0.060	0.073	0.069	0.041	0.024	0.077	0.035	0.049
0.1	0.064	0.107	0.120	0.142	0.136	0.082	0.046	0.158	0.070	0.097
0.2	0.126	0.208	0.247	0.270	0.259	0.163	0.085	0.310	0.140	0.192
0.5	0.307	0.494	0.673	0.599	0.582	0.427	0.214	0.764	0.353	0.477
1	0.59	0.93	1.51	1.03	1.01	0.92	0.39	1.56	0.73	0.95
2	1.12	1.67	4.02	1.59	1.62	2.16	0.68	3.23	1.60	1.90
5	2.36	3.24	261	2.38	2.54	13.2	1.25	13.3	5.10	4.85
10	3.86	4.84		2.86	3.29		1.74	28.6	21.5	10.1
20	5.67	6.39		3.21	3.61		2.23	359	584	22.4
50	7.72	8.00		3.68	4.02		2.50	845		85.7
100	8.71	9.02		4.56	4.78		2.66			226
200	9.65	12.0		5.81	6.23		3.07			303
300	11.1	16.8		6.69	7.31		3.49			383
500	15.9	29.4		8.06	8.98		4.10			603
700	21.9	48.8		9.20	10.4		4.60			861
760	23.9	56.0		9.52	10.8		4.63			943
900	29.2	88.2		10.2	11.7					
1000	33.8	129		10.8	12.4					

For example, if you are measuring the pressure in a system that is backfilled with argon, and the Model 906A display shows an indicated pressure of 23.9 torr, the true pressure is 760 torr. If the indicated pressure is 14 mtorr (0.014 torr), the true pressure is 20 mtorr (0.02 torr).

These data were compiled from a variety of sources, and are believed to be reliable, however Terranova Scientific, Inc.takes no responsibility for errors in the data. If your application is critical, we suggest you use the services of an independent laboratory to calibrate the gauge and Model 906A controller to your specific application.

VI 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. Follow the instructions below to change a fuse.

Unplug the line cord from the power entry module at the rear of the 906A; 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.

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.

C. Error Codes

The following Error Codes and their explanations will assist the Operator in diagnosing and resolving commonly encountered difficulties.

Error Code	Condition
E1	Action Not Allowed at This Time
E2	Parameter is at Limit
E3	Timeout During Setup
E11	Convection Tube VAC Adjustment Not Allowed at This Pressure
E12	Convection Tube ATM Adjustment Not Allowed at this Pressure

Figure 10: Error Codes

VII Trouble shooting

1. If the self-test fails:

run the self-test again by turning the power off and then on again. If it fails again, call Duniway Stockroom.

2. 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.
If the display comes on dimly and does not indicate the correct pressure, check to see that the proper voltage has been selected on the power input module.

3. If pressure readings are unreliable or noisy:

Check the connection to the gauge tube. Check that the gauge tube is clean and not contaminated; a contaminated or dirty gauge tube can cause erratic readings. Use an ohmmeter to check that none of the CONVECTRON® gauge pins are shorted to the metal housing of the tube.

4. If readings at VAC or ATM seem wrong:

A new gauge is calibrated by the manufacturer to be within 5 mTorr of true zero at vacuum, and within 20 torr at 760 torr. If recovery of factory settings (see **Operation** section) does not give readings which appear reasonable, it is possible that your gauge has become contaminated or damaged. You may try cleaning the gauge using acetone or TCE (1-1-1 trichloroethane). Be careful when using flammable solvents, so that you do not risk explosion from the flammable vapors.

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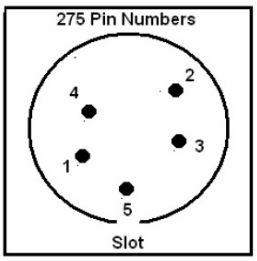
5. Resistance Reading for the CVT 275/CONVECTRON® Sensor Tube

For the CVT 275/CONVECTRON® gauge, you can measure to see if it has the correct internal resistance values. If the measured values differ from those shown, it is possible that your gauge has become damaged. These measurements must be made while the gauge is at atmospheric pressure; do not use a method which applies more than 10 mA to the pins or you will damage the fine internal wires.



between pins	resistance
1 and 2	20 ohm to 30 ohm
2 and 3	50 ohm to 60 ohm
1 and 5	175 ohm to 190 ohm

Figure 11: Resistance Readings for a Good CVT 275/CONVECTRON tube

If the resistance between pins 1 and 2 measures approx. 800 ohms, it means the internal sensor wire is broken and the CONVECTRON® gauge must be replaced.

6. Resistance Reading for CEP Sensor Tube

Looking at the connector end of the gauge tube, you will see a male 9 pin D connector. (See diagram below). It will have 5 pins in one row and 4 pins in the other row. With the 5-pin row on top, pin #1 is on the left side of the top row and pin #6 is on the left side of the bottom row. These measurements must be made while the gauge is at atmospheric pressure; do not use a method which applies more than 10 mA to the pins or you will damage the fine internal wires.

For a good tube, the following are the approximate resistances, pin to pin:

Between Pins;	**Resistance**
Pin 1 to Pin 7	20 ohms
Pin 1 to Pin 8	200 ohms
Pin 5 to Pin 7	48 ohms

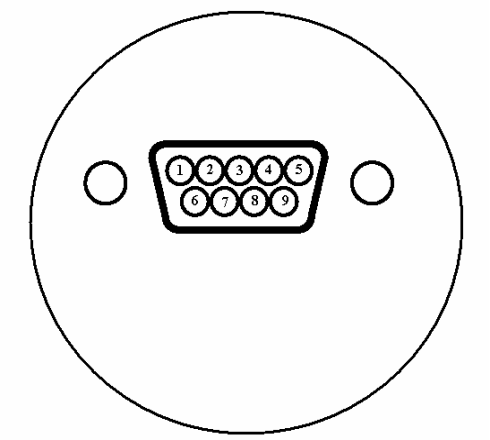


Figure 12: MKS/HPS Model 317 CEP (end view)

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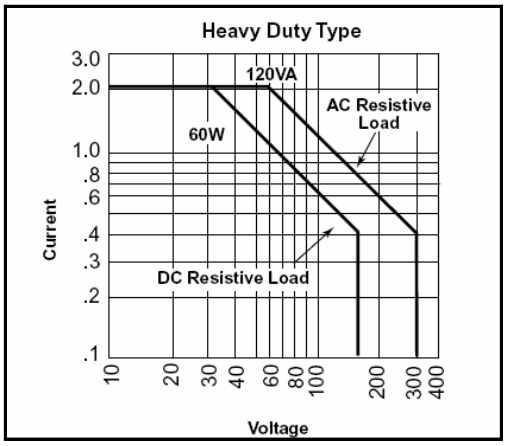
VIII Application Note

Protective Circuits for Set Point Relays

1. Rated Voltage vs. Current – Resistive Loads

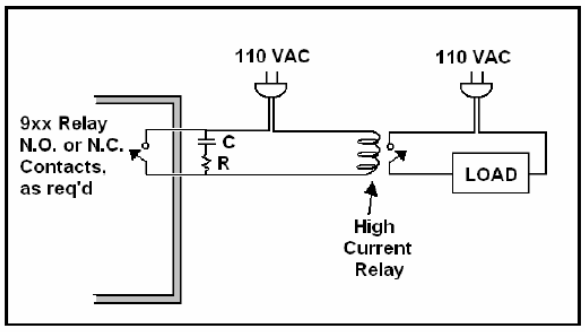
The graph below shows the relationship between the maximum voltage and current ratings specified for Heavy Duty Type AZ5 relays. These relays are used as Set Point Relays in the Terranova 9XX 1/8 DIN Vacuum Gauge Control Display products.



For resistive loads maximum current varies from 2 amps at 30 VDC (60 VAC) downward to 0.4 amps at 150 VDC (300VAC).

2. Protective Circuits for Non-Resistive Loads

For application of the Set Point relays for switching inductive or capacitive loads, it is advisable to use so-called "snubber" circuits, consisting of capacitors and resistors across the load. Such a circuit is shown in the diagram below. This circuit quenches any surges or arcs that might occur when switching such non-resistive loads.



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To calculate the values of C and R for the "snubber' circuits, the equations below give some guidance.

Snubber equations from CDE Quencharc paper:

$$C = \frac{I^2}{10} \qquad R = \frac{E_o}{10\,I\,(1 + \frac{50}{E_o})}$$

where C = capacitance in uF
I = load current in amperes prior to contact opening
R = resistance in ohms in series with capacitor
Eo = source voltage

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

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

For additional information on protective circuits for set point relays, please see the Potter and Brumfield publication on the following link:
http://www.pandbrelays.com/app_pdfs/13c3311.pdf

■
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IX Return Procedure

If you need to return the gauge controller to Duniway Stockroom for service, call first to 650-969-8811 or 800-446-8811 to obtain a Returned Material Authorization (RMA). Then pack the instrument securely, using the original packaging if it is available, being sure that the RMA number is clearly marked on the outside of the package.

X 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 prepay 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.

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XI 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 906A Convection Gauge Controller
Model 908A Dual Capacitance Diaphragm Gauge Controller
Model 926A Dual Convection 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: 1992, EN 50082-1: 1993

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

CE

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

Safety of Electrical Equipment for Laboratory Work
UL3101-1, 1st Edition
CAN/CSA C22.2 No. 1010.1-92

C ETL LISTED US
2003309

May 29, 2002

by: Sherman Rutherford
Compliance Manager

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