

DUNIWAY STOCKROOM CORP.

Terranova® 906A Single Convection-enhanced Pirani Gauge Control Unit



Instructions Manual Revision - 0916NC

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Specifications

Operating Voltage	Universal 100 V to 240 V AC @ 50 Hz to 60 Hz; 40 VA 100 V to 240 V DC
Pressure Display	3 Red LEDs – 3 digits (NNN) with pressure auto ranging
Pressure Units	Torr / mTorr (Default) mbar / μ bar
Measuring Range	1×10^{-4} Torr to 1000 Torr (Air / Nitrogen) (1×10^{-4} mbar to 1000 mbar)
Display Range	-14 mTorr to 995 Torr (-18 μ bar to 995 mbar)
Display Resolution	Varies From: 0.1 mTorr less than 100 mTorr (0.1 μ bar less than 100 μ bar) To: 5 Torr greater than 100 Torr (5 mbar greater than 100 mbar)
Accuracy	Pressure calculation algorithm is accurate to ± 1 % of published data for the MKS / HPS Series 317 and Granville-Phillips 275 Convectron [®] gauges (Accuracy does not include pressure gauge uncertainty)
Relay Rating	Varies From: 2 A at 30 V DC (60 V AC) To: 0.4 A at 150 V DC (300 V AC)
	See Appendix 4 for more details
Temperature Range	2°C to 50°C (in operation)
Weight	0.8 lbs / 0.4 kg

Accessories

Included
Instruction manual (Online)
One power cord
Two replacement fuses
Two panel mount clips
One unterminated male 15-pin D-sub connector

Required
(Sold separately)

275-CBL-1-10	GP 275 Convectron® & equivalent gauge cable (10 ft)*
CEP-CBL-1-10	MKS / HPS Series 317 Convection-enhanced Pirani & equivalent gauge cable (10 ft)*

See **Appendix 1** for a list of compatible pressure gauges

Optional
RS232-TN9DIN RS-232 serial communication cable (10 ft)*

* Custom cable lengths available upon request



Explosive Gases

Do not use the Terranova® 906A to measure the pressure of combustible gas mixtures. Although the pressure gauge normally operates at low temperatures, it is possible that momentary transients or controller malfunction can raise the pressure gauge above the ignition temperature of combustible mixtures. This, in turn, can create an explosion which can damage equipment and / or injure personnel.



Limitation on use of Compression Mounts

Do not use a compression port to connect pressure gauges to a vacuum system in applications that may develop above-atmospheric pressures. Pressures above atmospheric pressures may cause the pressure gauge to eject from a compression fitting and damage equipment and / or injure personnel.



Chemicals

Many organic cleaning solvents, such as acetone, produce fumes that are toxic and / or flammable. Such solvents should only be used in well-ventilated areas and away from electronic equipment, open flames, or other potential ignition sources.

Introduction

The Terranova® 906A Single Convection-enhanced Pirani Gauge Control Unit is designed to operate the Granville-Phillips 275 Convectron® gauge, MKS / HPS Series 317 convection-enhanced Pirani gauge, and equivalent pressure gauges. The Terranova® 906A covers the pressure range between 1000 Torr to 1×10^{-4} Torr (1000 mbar to 1×10^{-4} mbar).

Installation

Mounting the Terranova® 906A

The Terranova® 906A is housed in a standard 1/8 DIN box to allow for mounting on most equipment racks or cabinets. The dashed call-out dimensions in **Figure 1** illustrate the proper cutout dimensions for the 1/8 DIN box.

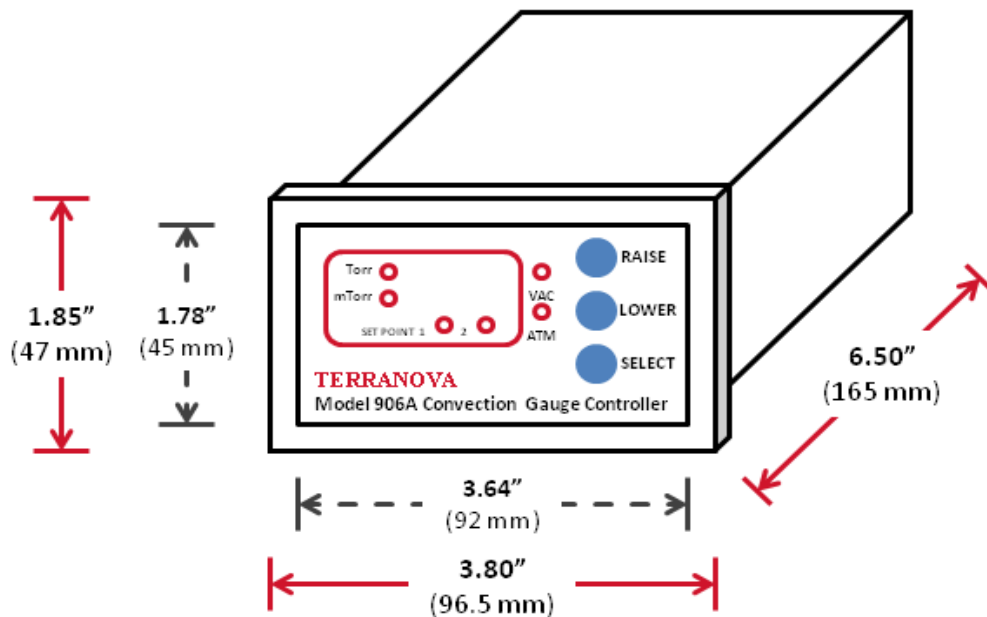


Figure 1. Terranova® 906A cutout and unit dimensions

To properly mount the unit:

1. Locate the mounting clips included with the control unit
2. With the square end of the mounting clip facing towards the front panel, slide the beveled surfaces of the clip under the cutout located on each side of the control unit
3. Push the clip toward the back of the unit until the central tongue locks the clip
4. Tighten the rod against the rack or panel to secure the unit

If successful, the clips should hold the Terranova® 906A in place. User should provide enough clearance to access rear cable connections.

Connecting the Pressure Gauge

The Terranova® 906A has a female 15-pin D-sub connection located on the back of the control unit labeled SENSORS to connect the pressure gauge cable (See **Figure 2**). User will require the Duniway gauge cable **275-CBL-1-10** to connect the Granville-Phillips 275 Convector® and equivalent gauges or the Duniway gauge cable **CEP-CBL-1-10** to connect the MKS / HPS Series 317 gauge to the control unit.

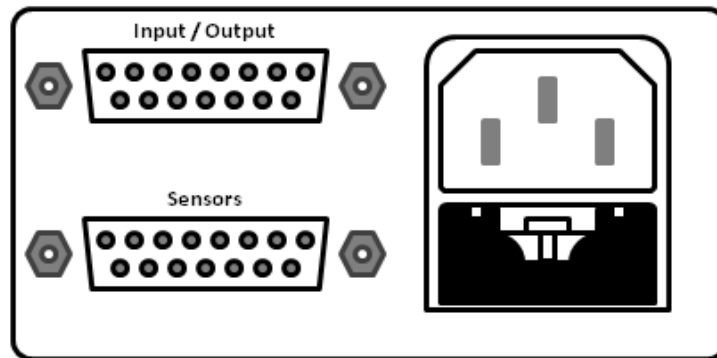


Figure 2. Terranova® 906A back view



Terranova® 906A should be OFF before connecting the pressure gauge. Plugging or unplugging the pressure gauge while the control unit is ON can damage pressure gauge internals.

To connect the Terranova® 906A to the respective pressure gauge:

1. Secure the pressure gauge cable end to the pressure gauge
2. Secure the male 15-pin D-sub connector of the cable to the SENSORS port
3. Fasten retainer screws (where applicable) on all cable connections

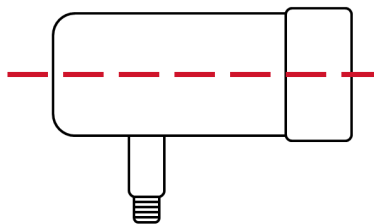


Figure 3. Pressure gauge orientation

The recommended convection-enhanced Pirani gauges should be installed with the axis horizontal, as shown in **Figure 3**, and the port pointing downward. Large errors can result at higher pressures if the axis is not horizontal. User should always ensure the pressure gauge is securely connected to the vacuum system before use.



Use of a pressure gauge other than the suggested types may lead to improper readings and / or cause damage to the pressure gauge.

Granville-Phillips Legacy Cable Conversion

Legacy Granville-Phillips 275 Convectron® control units that utilize gauge cables with an integrated AC power cord can be converted for use with the Terranova® 906A. To convert the gauge cable, the power cord must be removed and a male 15-pin D-sub connector should be installed at control unit cable end. See **Appendix 2** for Granville-Phillips 275 Convectron® gauge (and equivalent) cable configuration.

Operation

Self Test

The Terranova® 906A will perform a self test at power ON. The self test cycle is initiated by a BEEP sound followed by:

1. All LEDs become illuminated
2. Display reads the model number (i.e. 906)
3. Display reads the software version (e.g. 1.20)
4. Display reads the pressure units (e.g. TOR)
5. Display reads the pressure gauge curve (e.g. 275)

The control unit will commence normal operation if Self Test is successful.

Setup Mode

To set or modify the Terranova® 906A unit parameters:

1. Press the **SELECT** button to zero-adjust the control unit. Use the **RAISE** or **LOWER** button to increase or decrease the VAC pressure value shown on the display. VAC LED will flash during adjustment. See **Zero Adjustment**
2. Press the **SELECT** button a second time to adjust the atmospheric pressure value. Use the **RAISE** or **LOWER** button to increase or decrease the ATM pressure value shown on the display. ATM LED will flash during adjustment. See **Atmospheric Pressure Adjustment**



Display will read HI during Zero and Atmospheric Pressure Adjustment if gauge cable is connected, but pressure gauge is disconnected – TORR LED becomes illuminated; display will read LO if gauge cable is disconnected – mTORR LED becomes illuminated

3. Press the **SELECT** button a third time to set or adjust the SET POINT 1 pressure value. Use the **RAISE** or **LOWER** button to increase or decrease the pressure value shown on the display. Pressure value range is from 500 Torr to 3 mTorr (or mbar). Default value is OFF. SET POINT 1 LED will flash during adjustment. See **Set Point Operation**

4. Press the **SELECT** button a fourth time to set or adjust the SET POINT 2 pressure value. Use the **RAISE** or **LOWER** button to increase or decrease the pressure value shown on the display. Pressure value range is from 500 Torr to 3 mTorr (or mbar). Default value is OFF. SET POINT 2 LED will flash during adjustment. See **Set Point Operation**



Pressure unit LED does not illuminate if SET POINT is OFF

5. Press the **SELECT** button a fifth time to return the unit to normal operation

User must press and hold the **RAISE** or **LOWER** button until pressure value changes. Unit display will flash and pressure unit LED will illuminate during all four steps. Unit will return to normal operation in approximately 60 seconds if left unattended during Setup Mode; any changes will be saved. Timer is reset if any button is pressed during the 60-second timeout.

Zero Adjustment

Zero adjustment is recommended when installing a new pressure gauge or to restore pressure output accuracy. The Terranova® 906A can be either zero adjusted or set to a specific low pressure value via the VAC pressure value. Pressure reading must be less than approximately 50 mTorr (67 µbar) at initial set-up to adjust the VAC value. Error Code E11 will be output if pressure reading is greater than approximately 50 mTorr (67 µbar). Zero adjustment should be conducted before the atmospheric pressure adjustment.

For zero adjustment, VAC value should be set to approximately 0.0 mTorr and system pressure must be lower than 1×10^{-4} Torr (1×10^{-4} mbar) to display accurate pressure measurements. If millibar units are to be used, VAC value adjustment should be conducted in Torr units. VAC value is appropriately converted when switching between pressure units. Although VAC pressure value is stored by the control unit, it will not be displayed in subsequent adjustments.



Pressure reading range will shift if user accidentally changes the VAC value during use. If this occurs, user should reset the Terranova® 906A and redo both the zero and atmospheric pressure adjustment



Negative pressure readings during use or zero adjustment may indicate the control unit requires further adjustment. Negative pressure readings are to be used only as an indication of vacuum

Atmospheric Pressure Adjustment

Atmospheric pressure adjustment is recommended when installing a new pressure gauge or to restore pressure output accuracy. The Terranova® 906A can be set to either local atmospheric pressure – 760 Torr (1013 mbar) at sea level – or a specific high pressure value via the ATM pressure value. Pressure reading must be greater than approximately 200 Torr (267 mbar) at initial set-up to adjust the ATM value. Error Code E12 will be output if pressure reading is less than approximately 200 Torr (267 μ bar). Zero adjustment should be conducted before the atmospheric pressure adjustment.

If millibar units are to be used, ATM value adjustment should be conducted in Torr units. ATM value is appropriately converted when switching between pressure units. Although ATM pressure value is stored by the control unit, it will not be displayed in subsequent adjustments.



Pressure reading range will shift if user accidentally changes the ATM value during use. If this occurs, user should reset the Terranova® 906A and redo both the zero and atmospheric pressure adjustment

Changing Pressure Gauge Curve

The Terranova® 906A is able to output pressure readings based on the pressure curves of either the Granville-Phillips 275 Convectron® (i.e. 275) or the MKS / HPS Series 317 (i.e. CEP) gauge and equivalent pressure gauges. The default pressure gauge curve is 275.

To change between pressure gauge curves:

1. Disconnect AC power cord from control unit
2. Simultaneously depress the **RAISE** and **SELECT** buttons
3. Reconnect AC power cord to control unit

Once power is restored, the unit will commence the Self Test. If pressure gauge curve change is successful, two BEEPs will be emitted and the corresponding curve code will appear on the display. Thereafter, the Terranova® 906A will resume normal operation.

Changing Pressure Units

The Terranova® 906A is able to output pressure readings in Torr / mTorr or mbar / μ bar. Default pressure units for the Terranova® 906A are Torr / mTorr.

To change between pressure units:

1. Disconnect AC power cord from control unit
2. Simultaneously depress the **SELECT**, **RAISE**, and **LOWER** buttons
3. Reconnect AC power cord to control unit

Once power is restored, the unit will commence the Self Test. If pressure unit change is successful, two BEEPs will be emitted and the corresponding pressure units will appear on the display. Thereafter, the Terranova® 906A will resume normal operation.

Restoring Default Values

Restoring default parameters provides a starting point for control unit readjustment in the event pressure measurements become unreliable.

To restore Terranova® 906A default parameters:

1. Disconnect AC power cord from unit
2. Simultaneously depress the **RAISE** and **LOWER** buttons
3. Reconnect AC power cord to unit

Once power is restored, the unit will commence the Self Test. If reset process is successful, two BEEPs will be emitted and the code RST will appear on the display. Thereafter, the Terranova® 906A will resume normal operation.



Restoring default parameters will not affect the selected pressure unit

Pressure Measurement

Terranova® 906A operation is almost automatic and will commence after a successful Self Test. Pressure units will auto range during use as system pressure increases or decreases. The Terranova® 906A is set to output pressure readings based on air / nitrogen. If gases other than air / nitrogen are to be used, **Appendix 3** provides corrected pressure values for a number of gases including argon with respect to air / nitrogen. For example, if the vacuum system is backfilled with argon and the Terranova® 906A reads a vacuum pressure of 23.5 Torr, true system pressure is approximately 760 Torr.

Display will read OFF if gauge cable is not connected. Unit display will read HI if system pressure is greater than 995 Torr. Display will read LO if system pressure is lower than the minimum allowed pressure value. The control unit display will output the last ATM value if the pressure gauge is disconnected but the gauge cable is connected. Terranova® 906A pressure display resolution is as follows:

Step	Range
5 Torr	greater than 100 Torr
0.5 Torr	10 Torr to 100 Torr
0.05 Torr	5 Torr to 10 Torr
0.02 Torr	1 Torr to 5 Torr
1 mTorr	100 mTorr to 1000 mTorr
0.1 mTorr	less than 100 mTorr

Display resolution also applies to millibar units in the respective pressure ranges.



Due to a number of system variables, pressure differences may result with each subsequent pressure measurement and/or between different pressure gauges.

Set Point Operation

The Terranova® 906A can be utilized for process control functions through the use of two independent, programmable set points, SET POINT 1 and SET POINT 2, and corresponding relays. Set point pressure value is adjusted via the front panel; relay output is accessible through the INPUT / OUTPUT 15-pin D-sub connector port located in the back of the control unit. See **Table 1** for relay pin configuration.

Each relay will independently activate once the pressure reading is less than its corresponding set point value. The corresponding set point LED will become illuminated once the relay is active. The relay will deactivate once the pressure reading is greater than 5% of its set point value plus 1 mTorr (or 1 μ bar).

The relay deactivation pressure value can be determined by the following

$$S + 0.05 * S + 1 \text{ mTorr}$$

in which S is the set point pressure value in millitorr (or microbar). For example, if SET POINT 1 is 30 mTorr, its corresponding relay will activate once the pressure reading is below 30 mTorr and deactivate once the pressure reading is greater than 32.5 mTorr. If set point value is OFF, the respective relay will be disabled. Terranova® 906A set point pressure display resolution is as follows:

Step	Range
5 Torr	greater than 100 Torr
0.5 Torr	10 Torr to 100 Torr
0.05 Torr	5 Torr to 10 Torr
0.02 Torr	1 Torr to 5 Torr
1 mTorr	less than 1000 mTorr

Display resolution also applies to millibar units in the respective pressure ranges. See **Appendix 4** for relay use with inductive or capacitive load switching.

PIN	Function	Description	Notes
1	SET POINT 1 Relay	Normally closed (NC)	See Set Point Operation
2	SET POINT 1 Relay	Common	See Set Point Operation
3	SET POINT 1 Relay	Normally open (NO)	See Set Point Operation
4	SET POINT 2 Relay	Normally closed (NC)	See Set Point Operation
5	SET POINT 2 Relay	Common	See Set Point Operation
6	SET POINT 2 Relay	Normally open (NO)	See Set Point Operation
7	Tx		See Serial Communication
8	Rx		See Serial Communication
9	Analog Common		See Serial Communication
10	Digital Common		
11	Digital Common		
12	Voltage Output	+5 V	See NOTES
13	Analog Output		See Analog Output
14	Digital Common		
15	Bridge Output		See NOTES

Table 1. INPUT / OUTPUT port pin configuration

NOTES

- PIN 12 Nominal voltage output available for external use;
1 kΩ source impedance
- PIN 15 Pressure gauge bridge voltage – to be used with Digital Common;
10 kΩ source impedance

Serial Communication

The INPUT / OUTPUT 15-pin D-sub port allows the user to remotely query the Terranova® 906A to read unit parameter values. The serial communication standard used for data transmission is RS-232. The RS-232 format for communication with the Terranova® 906A unit is as follows:

RS-232 Settings
9600 baud
No parity
8 bits
1 stop bit
Full duplex

Figure 4 illustrates the pin configuration for RS-232 communication. User will require the Duniway cable **RS232-TN9DIN** and a separate program, such as HyperTerminal, to send query characters and read output from the control unit. **Table 2** lists the characters used by the Terranova® 906A to return unit parameters.

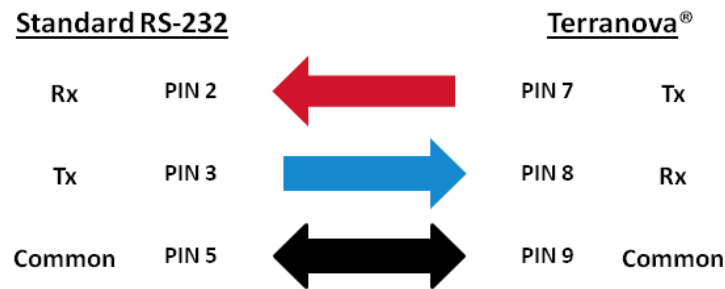


Figure 4. Terranova® 906A RS-232 pin configuration

The Terranova® 906A outputs pressure values in the following scientific notation format

$$XeY,$$

in which *X* is the significand and *Y* is the exponent. The control unit also utilizes the same format to output set point values. However, a third digit, *R*, is appended to the output which indicates the set point relay state. If the relay is active, *R* = 1; otherwise, *R* = 0. Depending on the selected pressure units, output pressure values are in either Torr or mbar.

Character	Query	Output format	Notes
p	Pressure reading	XeY	ASCII Value 112
1	SET POINT 1 value	XeY R	ASCII Value 49
2	SET POINT 2 value	XeY R	ASCII Value 50
u	Pressure unit	Torr / mBar	ASCII Value 117
v	Model number; Software version	906, ver N.NN	ASCII Value 118
x	Pressure gauge curve	275, CEP	ASCII Value 120

Table 2. Serial communication query characters

Examples	
Pressure: 2.30 mbar	p
Output:	2.30e+0
Pressure: HI	p
Output:	999e+0
Pressure: LO	p
Output:	-20e-3
Pressure: OFF	p
Output:	-99e-3
SET POINT 1 pressure: 70 mTorr (Relay ON)	1
Output:	70.0e-3 1
SET POINT 2 pressure: OFF (Relay OFF)	2
Output:	0.00e+0 0

Analog Output

The Terranova® 906A has a calibrated, 12-bit resolution, logarithmic analog output available for use as a secondary method to read measured pressure values. Analog output voltage can be accessed through the INPUT / OUPUT 15-pin D-sub connector port. The unit outputs 0.50 V per pressure decade (or order of magnitude). LO pressure value corresponds to 0.00 V; OFF / HI pressure value corresponds to approximately 3.00 V. See **Table 1** for pin configuration.

The analog output voltage can be approximated using the displayed pressure measurement by

$$V = 0.50 * \log_{10} P$$

where P is the pressure reading in mTorr (or μ bar) and V is the analog output in volts. For example, if P is equal to 10.0 mTorr, V (rounded to nearest hundredth) is equal to 0.50 V. **Table 3** lists sample analog output and corresponding pressure values. For example, if analog output is 2.00 V, the corresponding pressure reading is 10 Torr.

Analog Output [V]	Pressure
0.01	1.0 mTorr
0.15	2.0 mTorr
0.35	5.0 mTorr
0.50	10.0 mTorr
1.00	100 mTorr
1.15	200 mTorr
1.35	500 mTorr
1.50	1 Torr
2.00	10 Torr
2.15	20 Torr
2.50	100 Torr
2.99	1000 Torr

Table 3. Analog output and calculated pressure values

Pressure as a function of the analog output can be approximated by

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

where V is the analog output in volts and P is pressure in mTorr (or μbar). For example, if V is equal to 1.15 V, P (rounded to the nearest one) is 200 mTorr.



1 k Ω source impedance for analog output

Troubleshooting

Problem	Possible Cause	Diagnostic
Unit fails Self Test	N/A	Restart unit; if restart fails, contact Duniway Stockroom
Fuse(s) repeatedly burn out	Incorrect AC voltage	Verify AC voltage; if unit fails, contact Duniway Stockroom
Display is dim and reads incorrect pressure values	Incorrect AC voltage	Verify AC voltage; if unit fails, contact Duniway Stockroom
Incorrect VAC / ATM values	Faulty pressure gauge	Replace pressure gauge

Error Code	Description
E01	Operation not allowed
E02	Parameter at limit
E03	Timeout during Setup Mode
E11	VAC adjustment not allowed at current pressure
E12	ATM adjustment not allowed at current pressure

Pressure Gauge

The Granville-Phillips 275 Convectron® gauge and MKS / HPS Series 317 gauge have internal resistance values indicative of an operational pressure gauge. User should first reset the Terranova® 906A to correct any controller problems. If resetting does not resolve the problem, user may clean the inside of the pressure gauge. A cleaning agent such as acetone or toluene may be used to carefully clear away any contaminants. The pressure gauge should be replaced if resistances greatly deviate or if cleaning does not provide reasonable pressure readings.



Chemicals

Many organic cleaning solvents, such as acetone, produce fumes that are toxic and/or flammable. Such solvents should only be used in well-ventilated areas and away from electronic equipment, open flames, or other potential ignition sources.

Granville-Phillips 275 Convectron® Gauge

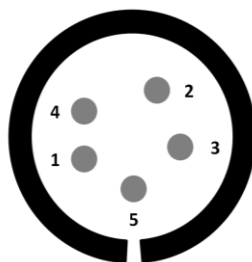


Figure 5. Granville-Phillips 275 Convectron® gauge pin configuration

PIN	Resistance [Ω]
1 & 2	18 to 23
2 & 3	50 to 60
1 & 5	180 to 185

Table 4. Granville-Phillips 275 Convectron® gauge resistance values

If the measured resistance values significantly differ from those provided in **Table 4**, the pressure gauge may be damaged, contaminated, or defective. If the resistance between PIN 1 and PIN 2 is approximately 800 Ω , the sensor wire in the gauge is broken. If the resistance values are correct but the pressure gauge does not output proper measurements, the gold plating on the tungsten sensor wire may have eroded. For all instances, the pressure gauge should be replaced.¹



To prevent damage to the sensor wire, tests should not be performed with instruments that apply voltages greater than 0.1 V at vacuum or 2.0 V at atmospheric pressure.

MKS / HPS Series 317 Convection-enhanced Pirani Gauge

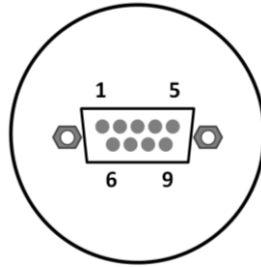


Figure 6. MKS / HPS Series 317 gauge pin configuration

PIN	Resistance [Ω]
1 & 7	20
1 & 8	184
5 & 7	48

Table 5. MKS / HPS Series 317 gauge resistance values

If the measured resistance values significantly differ from those provided in **Table 5**, the pressure gauge may be damaged, contaminated, or defective. Tests should be performed at atmospheric pressure and room temperature (i.e. 20 °C).²



Tests should not be performed with instruments which output greater than 5 mA.

1. Brooks Automation, Inc. 'Granville-Phillips® Series 475 Convector® Vacuum Measurement Controller Instruction Manual'. 2009. 81.
2. MKS Instruments. 'HPS Series 947 Digital Convection Enhanced Pirani (CEP) Vacuum Sensor System Operation and Maintenance Manual'. 1999. 25.

Changing Fuses

The Terranova® 906A contains two Type F, regular (or slow-blow) 1 A fuses. As shown in **Figure 7**, both fuses are held in the fuse assembly located on the back panel of the unit.

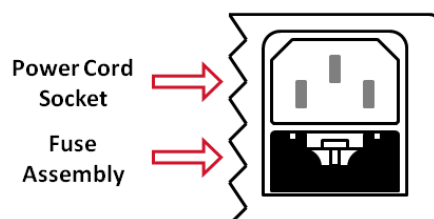


Figure 7. Terranova® 906A power module

To change fuses:

1. Unplug the line cord from the unit power module
2. Locate the fuse block immediately below the power cord socket
3. Press the tab of the fuse block and withdraw the assembly
4. Inspect and replace faulty fuse(s)
5. Reinsert fuse assembly into power module
6. Push fuse assembly into place until assembly tabs “click”

Recommended Fuses
Bussman GDB-1A
Bussman GDC-1A
Littelfuse 217 001
Littelfuse 218 001

Legacy Terranova® 906

The legacy Terranova® 906 model has been discontinued and replaced by the Terranova® 906A to increase the reading accuracy between the two types of convection-enhanced Pirani gauges. Earlier legacy Terranova® 906 models did not possess universal power modules. User should verify proper input voltage by locating the stamped rating on the rear end of the unit. Although the Terranova® 906 has been discontinued, the control unit may still be sent to Duniway Stockroom for repairs. Contact your Duniway Stockroom customer service representative for further details.

Warranty

Duniway Stockroom Corporation (“DSC”) warrants all Terranova® products 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 item(s). Shipping damage is excluded from the scope of this warranty. Pressure gauges 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 DSC receives notice of such defects during the warranty period, DSC will repair or replace firmware that does not execute its programming instruction due to such defects. DSC does not warrant that the operation of the firmware or hardware will be uninterrupted or error-free.

If this product is returned to DSC for warranty service, Buyer will prepay shipping charges and pay all duties and taxes for products returned to DSC. DSC will pay for the 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 the 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. DSC 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 DSC be liable for direct, indirect, special, incidental, or consequential damages, including loss of profits, whether based on contract, tort, or any other legal theory.

Please contact your Duniway Stockroom customer service representative for a Return Merchandise Authorization (RMA) number if you need to return a Terranova® product.

Declaration of Conformity

Duniway Stockroom Corp. declares under its sole responsibility that the following products:

Terranova® 906A Convection Gauge Controller
Terranova® 908A Dual Capacitance Diaphragm Gauge Controller
Terranova® 926A Dual Convection Gauge Controller

which display the CE mark 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

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

May 29, 2002

Appendix 1. Terranova® 906A Compatible Pressure Gauges

Duniway Part No.	Description	Fitting
GP275-071	Granville-Phillips 275 Convectron® gauge ^{1**}	1/8" Male NPT
CVT-275-101	Duniway Convection-enhanced Pirani ^{2**}	¼" Female VCR
CVT-275-133	Duniway Convection-enhanced Pirani ^{2**}	1/8" Male NPT
CVT-275-KF25	Duniway Convection-enhanced Pirani ^{2**}	KF25
CVT-275-VCR-4	Duniway Convection-enhanced Pirani ^{2**}	Mini Conflat
CEP-HPS-SH	MKS/HPS Series 317 Shielded Convection-enhanced Pirani ^{3**}	1/8" Male NPT
CEP-HPS-KF16SH	MKS/HPS Series 317 Shielded Convection-enhanced Pirani ^{3**}	KF16

** Other fittings available upon request

¹ Bakeable up to 150°C (non-operating)

² Compatible, plug-in replacement for Granville-Phillips 275 Convectron® gauge

³ UHV compatible materials; bakeable up to 200°C

Appendix 2. Gauge Cable Diagrams

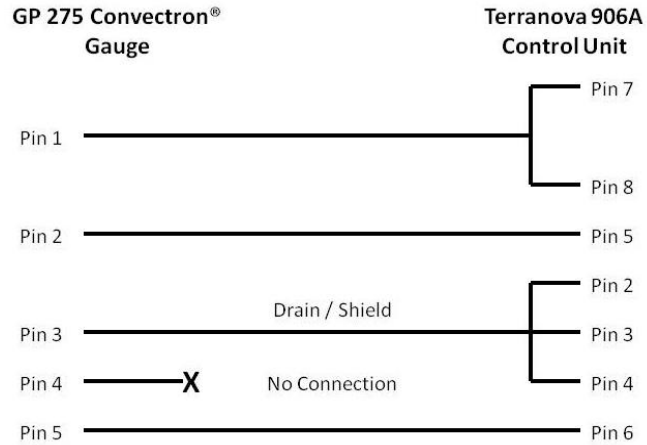


Figure 1. Terranova® 906A to GP 275 Convectron® gauge cable configuration

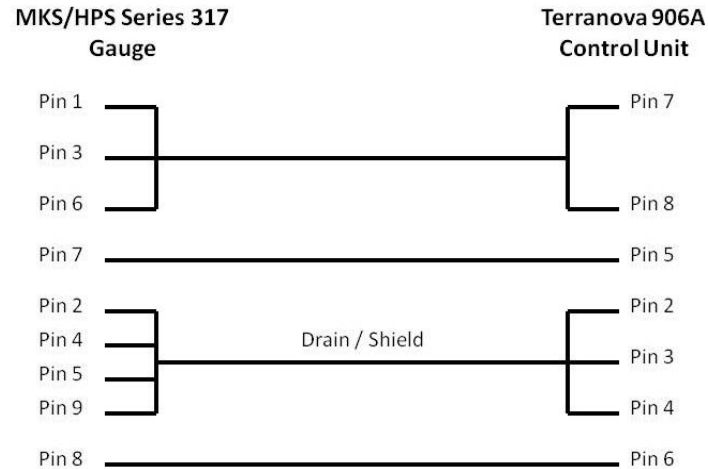


Figure 2. Terranova® 906A to MKS / HPS Series 317 gauge cable configuration

Appendix 3. Corrected Pressure Values for GP 275 Convectron® Gauge

True Pressure [Torr]	Indicated Pressure [Torr]								
	Ar	CO ₂	Deuterium	Freon-22	He	Kr	Methane	Ne	Oxygen
1 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴	2 x 10 ⁻⁴	1 x 10 ⁻⁴	1 x 10 ⁻⁴
2 x 10 ⁻⁴	1 x 10 ⁻⁴	2 x 10 ⁻⁴	2 x 10 ⁻⁴	2 x 10 ⁻⁴	2 x 10 ⁻⁴	2 x 10 ⁻⁴	3 x 10 ⁻⁴	1 x 10 ⁻⁴	2 x 10 ⁻⁴
5 x 10 ⁻⁴	2 x 10 ⁻⁴	6 x 10 ⁻⁴	5 x 10 ⁻⁴	7 x 10 ⁻⁴	4 x 10 ⁻⁴	3 x 10 ⁻⁴	8 x 10 ⁻⁴	3 x 10 ⁻⁴	5 x 10 ⁻⁴
1 x 10 ⁻³	7 x 10 ⁻⁴	1.1 x 10 ⁻³	1.9 x 10 ⁻³	1.4 x 10 ⁻³	8 x 10 ⁻⁴	5 x 10 ⁻⁴	1.8 x 10 ⁻³	7 x 10 ⁻⁴	1.0 x 10 ⁻³
2 x 10 ⁻³	1.3 x 10 ⁻³	2.3 x 10 ⁻³	2.4 x 10 ⁻³	2.9 x 10 ⁻³	1.6 x 10 ⁻³	1.0 x 10 ⁻³	3.2 x 10 ⁻³	1.4 x 10 ⁻³	2.0 x 10 ⁻³
5 x 10 ⁻³	3.3 x 10 ⁻³	5.5 x 10 ⁻³	6.0 x 10 ⁻³	6.8 x 10 ⁻³	4.0 x 10 ⁻³	2.3 x 10 ⁻³	7.7 x 10 ⁻³	3.5 x 10 ⁻³	4.9 x 10 ⁻³
1 x 10 ⁻²	6.5 x 10 ⁻³	1.09 x 10 ⁻²	1.20 x 10 ⁻²	1.35 x 10 ⁻²	8.0 x 10 ⁻³	4.6 x 10 ⁻³	1.52 x 10 ⁻²	7.0 x 10 ⁻³	9.7 x 10 ⁻³
2 x 10 ⁻²	1.40 x 10 ⁻²	2.20 x 10 ⁻²	2.40 x 10 ⁻²	2.70 x 10 ⁻²	1.60 x 10 ⁻²	9.0 x 10 ⁻³	3.10 x 10 ⁻²	1.40 x 10 ⁻²	2.00 x 10 ⁻²
2 x 10 ⁻²	3.30 x 10 ⁻²	5.50 x 10 ⁻²	6.00 x 10 ⁻²	6.90 x 10 ⁻²	4.10 x 10 ⁻²	2.40 x 10 ⁻²	7.70 x 10 ⁻²	3.50 x 10 ⁻²	4.90 x 10 ⁻²
1 x 10 ⁻¹	6.40 x 10 ⁻²	1.07 x 10 ⁻¹	1.20 x 10 ⁻¹	1.36 x 10 ⁻¹	8.20 x 10 ⁻²	4.60 x 10 ⁻²	1.58 x 10 ⁻¹	7.00 x 10 ⁻²	9.70 x 10 ⁻²
2 x 10 ⁻¹	1.26 x 10 ⁻¹	2.08 x 10 ⁻¹	2.47 x 10 ⁻¹	2.59 x 10 ⁻¹	1.63 x 10 ⁻¹	8.50 x 10 ⁻²	3.10 x 10 ⁻¹	1.40 x 10 ⁻¹	1.92 x 10 ⁻¹
5 x 10 ⁻¹	3.07 x 10 ⁻¹	4.94 x 10 ⁻¹	6.73 x 10 ⁻¹	5.82 x 10 ⁻¹	4.27 x 10 ⁻¹	2.14 x 10 ⁻¹	7.64 x 10 ⁻¹	3.53 x 10 ⁻¹	4.77 x 10 ⁻¹
1	5.90 x 10 ⁻¹	9.30 x 10 ⁻¹	1.52	1.02	9.20 x 10 ⁻¹	3.90 x 10 ⁻¹	1.56	7.30 x 10 ⁻¹	9.50 x 10 ⁻¹
2	1.12	1.68	4.02	1.62	2.16	6.80 x 10 ⁻¹	3.24	1.60	1.90
5	2.36	3.24	265	2.54	13.5	1.26	13.5	5.10	4.85
10	3.86	4.84		3.30		1.74	29.0	21.5	10.5
20	5.70	6.40		3.62		2.24	360	585	22.5
50	7.75	8.00		4.02		2.50	845		86.0
100	8.75	9.05		4.78		2.66			230
200	9.65	12.0		6.25		3.08			305
300	11.5	17.0		7.31		3.50			385
500	16.0	29.5		8.98		4.10			605
700	22.0	49.0		10.5		4.60			865
760	24.0	56.0		11.0		4.64			945
900	29.5	88.5		12.0					
1000	34.0	130		12.5					

Data was compiled from a number of sources and is provided as a guide. If pressure readings are critical to application, user should consult a vacuum pressure gauge calibration specialist.

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Appendix 4. Notes on Terranova® Set Point Relays

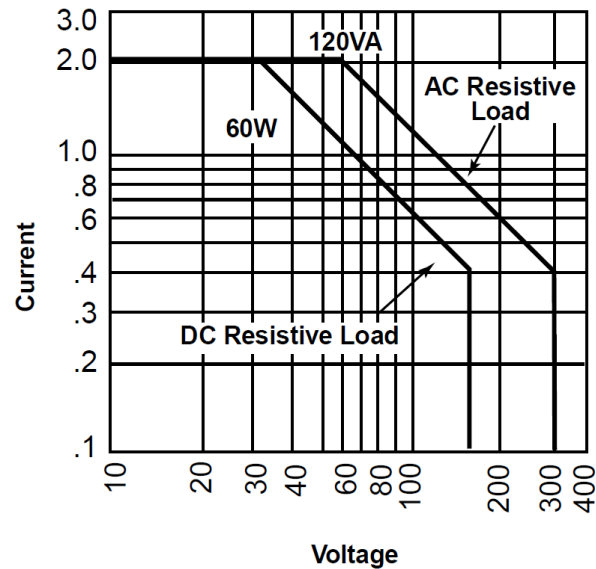


Figure 1. Heavy Duty Type AZ5 relay voltage-current relationship

The Heavy Duty Type AZ5 relay is used in the Terranova® 906A to control external functions. As shown in **Figure 1**, maximum current varies from 2 A at 30 V DC (60 V AC) to 0.4 A at 150 V DC (300 V AC) for resistive loads.

Protective Circuits for Inductive Loads

A protective circuit or component is recommended when switching inductive loads to suppress sudden voltage spikes. One method to suppress high voltage spikes in an AC circuit is through the use of a “snubber” circuit. A “snubber” circuit consists of a capacitor and resistor across an inductive load. As shown in **Figure 2**, the “snubber” circuit is parallel to the load.

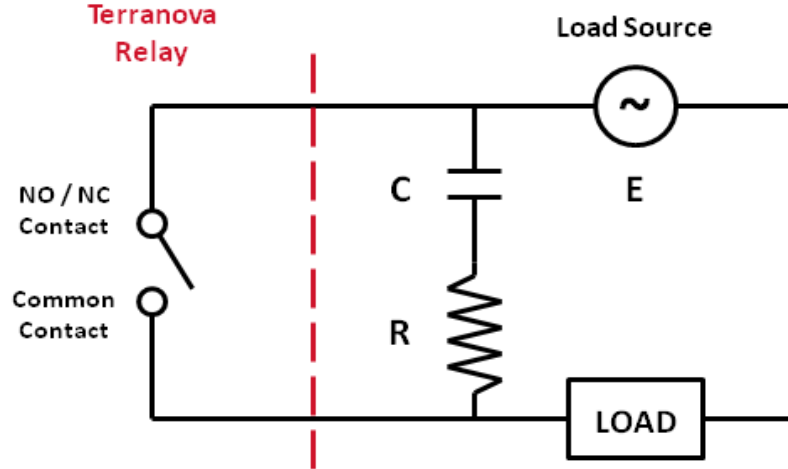


Figure 2. Example of a “snubber” circuit

To calculate the appropriate capacitor C in microfarads [μF] and resistor R in ohms [Ω] to use in the “snubber” circuit, Paktron Capacitors’ Quencharc® technical note¹ suggests the following empirical equations

$$C = \frac{I^2}{10} \quad (1), \text{ and}$$

$$R = \frac{E}{10I\left(1 + \frac{50}{E}\right)} \quad (2),$$

where I is the load current prior to contact opening in amperes [A] and E is the source voltage in volts [V]. For example, if **Figure 2** shows a 1 A load with a 110 V AC source connected in series with the Terranova® relay, $I = 1$ A and $E = 110$ V AC. Therefore, Equation 1 provides a capacitance value of 0.1 μF ; Equation 2 provides a resistance value of approximately 8 Ω . Thus, a 0.1 μF capacitor and a 10 Ω resistor should be used for the “snubber” circuit. However, the voltage and power rating of the capacitor and resistor, respectively, must be taken into consideration to meet circuit requirements. User should also consider similar protective circuits or components to suppress current spikes in capacitive loads.

1. Pancon Corporation. ‘2012 Catalog’. 2012. 18-19. Web. http://www.panconcorp.com/PDFs/Catalogs/Paktron_2012catalog.pdf