DUNIWAY STOCKROOM CORP.

Terranova® 926A

Dual Convection-enhanced Pirani Gauge Control Unit

Instruction Manual

rev1016NC

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Specifications

Operating Voltage	Universal: 100V to 240V AC @ 50Hz to 60Hz; 40VA 100V to 240V DC
Pressure Display	3 Red LEDs - 3 digits (NNN) with pressure unit auto ranging
Pressure Units	Torr/mTorr [Default] ; mbar/µbar
Measuring Range	1 x 10^{-4} Torr to 1000 Torr ; (Air/Nitrogen) (1 x 10^{-4} mbar to 1000 mbar)
Display Range	-19 mTorr to 995 Torr; (-19 µbar to 995 mbar)
Display Resolution	Varies From: 0.1 mTorr below 100 mTorr (0.1 µbar below 100 µbar) To: 5 Torr above 100 Torr (5 mbar above 100 mbar)
Accuracy	Pressure calculation algorithm is accurate to ±1% of published data for the MKS/HPS Series 317 & Granville-Phillips 275 Convectron® gauges (accuracy does not include pressure gauge uncertainty)
Relay Rating	Varies From: 2A at 30 VDC (60 VAC) To: 0.4A at 150 VDC (300 VAC) See Appendix 4 for more details
Temperature Range	2ºC to 500ºC (in operation)
Environmental Considerations	Not for use with explosive or corrosive gases
Weight	1.0lb/0.5kg

Accessories

Included	Instruction Manual (can be accessed at www.duniway.com/documents/manuals) One power cord Two replacement fuses Two panel mount clips One unterminated male 15-pin D-sub connector
Required (Sold Separately)	**275-CBL-2-10** Dual GP 275 Convectron® & equivalent gauge cable (10ft)* **CEP-CBL-2-10** Dual MKS/HPS Series 317 Convectron-enhanced Pirani & equivalent gauge cable (10ft)* See Appendix 1 for a list of compatible pressure gauges
Optional	**RS232-TN9DIN** RS-232 serial communication cable (10ft)*

*Custom cable lengths available upon request

Explosive Gases

Do not use the Terranova® 926A 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® 926A Dual Convection Gauge Controller is designed to simultaneously operate two Granville-Phillips 275 Convectron® gauges, two MKS / HPS Series 317 convection-enhanced Pirani gauges, or two equivalent pressure gauges. The Terranova® 926A covers the pressure range between 1000 Torr to 1 x 10^{-4} Torr (1000 mbar to 1 x 10^{-4} mbar).

Installation

Mounting the Terranova® 926A

The Terranova® 926A 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.

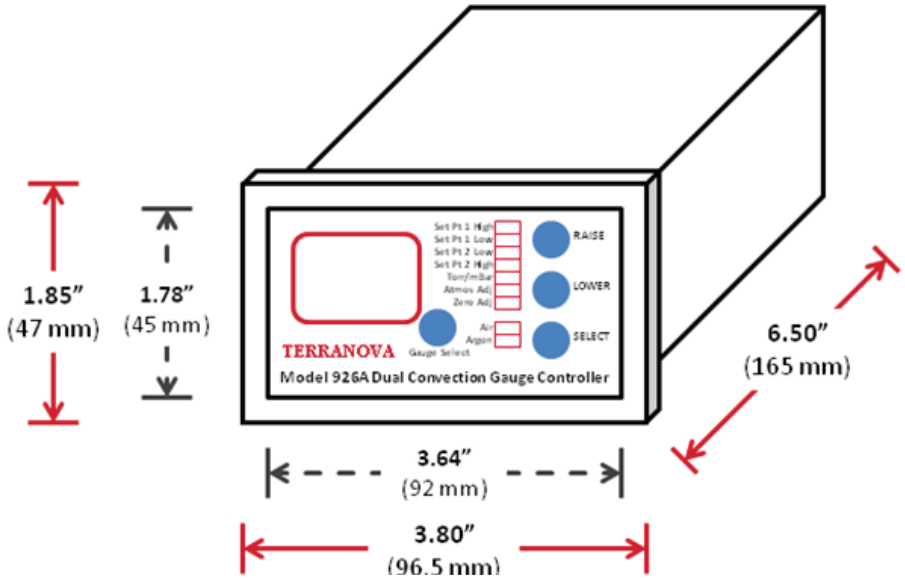

Figure 1 Terranova® 926A Dimensions

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® 926A in place. User should provide enough clearance to access rear cable connections.

Connecting the Pressure Gauge

The Terranova® 926A has a female 15-pin D-sub connection located on the back of the control unit labeled SENSOR(S) to connect the pressure gauge cable (See Figure 2). A dual cable is required to simultaneously connect both pressure gauges. User will require the Duniway gauge cable 275-CBL-2-10 to connect the Granville-Phillips 275 Convectron® gauges and equivalent pressure gauges to the control unit. Similarly, the user will require the Duniway gauge cable CEP-CBL-2-10 to connect the MKS / HPS Series 317 gauges or equivalent pressure gauges to the control unit.

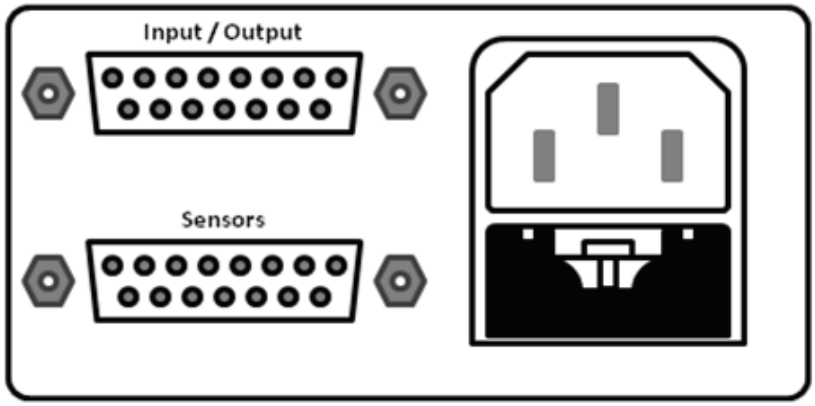

Figure 2 Terranova® 926A Back Panel

The Terranova® 926A should be OFF before connecting the pressure gauge. Plugging or unplugging the pressure gauge while the control unit is ON can damage internal parts of the pressure gauge.

To connect the Terranova® 926A 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

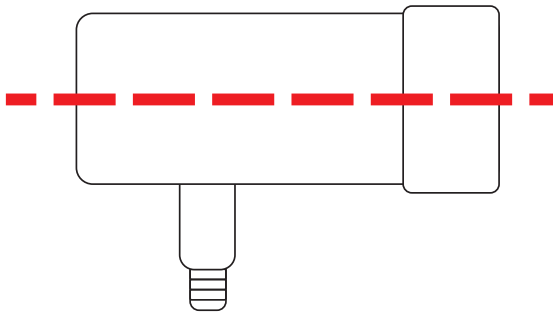

Figure 3 Proper orientation for operation of a convection-enhanced Pirani gauge

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 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® 926A. To convert the gauge cable, the power cord must be removed and a male 15-pin D-sub connector should be installed at the control unit cable end. See Appendix 2 for Granville-Phillips 275 Convectron® gauge (and equivalent) cable configuration.

Operation

Self Test

The Terranova® 926A will perform a self test at power ON. The Self Test cycle is initiated by a BEEP sound followed by:

1. All LEDs momentarily illuminate
2. Numeric display indicators and mBar LED become illuminated
3. Pressure unit LEDs become illuminated
4. Pressure gauge LED indicators become illuminated
5. Parameter LEDs become illuminated
6. Display reads the model number (e.g. 926)
7. Display reads the software version (e.g. 1.50)
8. Display reads the pressure gauge curve (e.g. 275 or CEP)

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

Setup Mode

Terranova® 926A unit parameters can be set or modified by the following nine-step operation:

1. Press the **SELECT** button to set or adjust the relay deactivation pressure for SET POINT 1. Use the **RAISE** or **LOWER** button to increase or decrease the SET PT 1 HIGH pressure value shown on the display. Pressure range is from 500 Torr to 4 x 10^{-3} Torr. Default value is OFF. SET PT 1 HIGH LED will illuminate during adjustment. See **Set Point Operation**.

2. Press the **SELECT** button a second time to set or adjust the relay activation pressure for SET POINT 1. Use the **RAISE** or **LOWER** button to increase or decrease the SET PT 1 LOW pressure value shown on the display. Pressure range is from 495 Torr to 3 x 10^{-3} Torr. Default value is OFF. SET PT 1 LOW LED will illuminate during adjustment. See **Set Point Operation**.

3. Press the **SELECT** button a third time to set or adjust the relay deactivation pressure for SET POINT 2. Use the **RAISE** or **LOWER** button to increase or decrease the SET PT 2 HIGH pressure value shown on the display. Pressure range is from 500 Torr to 4 x 10^{-3} Torr. Default value is OFF. SET PT 2 HIGH LED will illuminate during adjustment. See **Set Point Operation**.

4. Press the **SELECT** button a fourth time to set or adjust the relay activation pressure for SET POINT 2. Use the **RAISE** or **LOWER** button to increase or decrease the SET PT 2 LOW pressure value shown on the display. Pressure range is from 495 Torr to 3 x 10^{-3} Torr. Default value is OFF. SET PT 2 LOW LED will illuminate during adjustment. See **Set Point Operation**.

Although the SET PT HIGH and SET PT LOW parameter may be independently assigned to operate with either pressure gauge, both values will apply to the pressure gauge selected for the SET PT LOW value. Use the GAUGE SELECT button to choose between GAUGE 1 and GAUGE 2.

5.Press the **SELECT** button a fifth time to set the pressure units for both pressure gauges. Use the **RAISE** or **LOWER** button to select between torr and millibar pressure units. Default pressure unit is Torr. The corresponding pressure unit LEDs will illuminate during adjustment.

6. Press the **SELECT** button a sixth time to adjust the atmospheric pressure value. Use the **RAISE** or **LOWER** button to increase or decrease the ATMOS ADJ pressure value shown on the display. ATMOS ADJ LED will illuminate during adjustment. See **Atmospheric Pressure Adjustment**.

7. Press the **SELECT** button a seventh time to zero-adjust the control unit. Use the **RAISE** or **LOWER** button to increase or decrease the ZERO ADJ pressure value shown on the display. Zero ADJ LED will illuminate during adjustment. See **Zero Adjustment**.

The zero and atmospheric pressure parameter may be independently adjusted for each pressure gauge. Use the GAUGE SELECT button to choose between GAUGE 1 and GAUGE 2.

8. Press the **SELECT** button an eighth time to set the gas response curve for both pressure gauges. Use the RAISE or LOWER to select between AIR and ARGON. Default gas response curve is AIR. The code GAS will flash on the display and the corresponding gas curve LED will illuminate during adjustment.

9. Press the **SELECT** button a ninth 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® 926A can be either zero adjusted or set to a specific low pressure value via the ZERO ADJ pressure value. Pressure reading must be less than approximately 50 mTorr (67 µbar) at initial set-up to adjust the ZERO ADJ 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, ZERO ADJ 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. Although ZERO ADJ pressure value is stored by the control unit, it will not be displayed in subsequent adjustments. ZERO ADJ value is appropriately converted when switching between pressure units.

Pressure reading range will shift if user accidentally changes the ZERO ADJ value during use. If this occurs, user should reset the Terranova® 926A 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® 926A can be set to either local atmospheric pressure – 760 Torr (1013 mbar) at sea level – or a specific high pressure value via the ATMOS ADJ pressure value. Pressure reading must be greater than approximately 260 Torr (350 mbar) at initial set-up to adjust the ATMMOS ADJ value. Error Code E12 will be output if pressure reading is less than approximately 260 Torr (350 mbar). Zero adjustment should be conducted before the atmospheric pressure adjustment.

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

Pressure reading range will shift if user accidentally changes ATMOS ADJ value during use. If this occurs, user should reset the Terranova® 926A and redo both the zero and atmospheric pressure adjustment.

Changing Pressure Gauge Curve

The Terranova® 926A is able to output pressure readings based on the pressure curves of either the Granville-Phillips 275 Convectron® (e.g. 275) or the MKS/HPS Series 317 (e.g. CEP) presuue 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® 926A 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® 926A 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® 926A will resume normal operation.

Restoring default parameters will not affect the selected pressure unit

Pressure Measurement

Terranova® 926A 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® 926A 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 carbon dioxide (CO_2) and the Terranova® 926A reads a vacuum pressure of 29.4 Torr, true system pressure is approximately 500 Torr.

Although the Terranova® 926A is able to simultaneously operate two pressure gauges, only one pressure gauge reading will be displayed at a time. User can select between GAUGE 1 and GAUGE 2 using the GAUGE SELECT button to display the corresponding pressure readings. The selected pressure gauge LED will illuminate during use.

Unit display will read OFF if gauge cable is disconnected. Unit display will read HI if system pressure is greater than 995 Torr or if the pressure guage is disconnected, but the gauge cable is connected to the unit. Display will read LO if system pressure is less than the minimum allowed pressure value by the control unit. Terranova® 926A 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	1Torr 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® 926A 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. Each set point has an adjustable activation (e.g. SET POINT LO) and deactivation (i.e. SET POINT HI) pressure value that allows the user to modify the relay hysteresis. SET PT 1 HIGH and SET PT 1 LOW correspond to SET POINT 1; SET PT 2 HIGH and SET PT 2 LOW correspond to SET POINT 2. Set point pressure values are 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 LOW value. The relay will deactivate once the pressure reading is greater than its corresponding SET POINT HIGH value. Relays will be disabled if set point value is OFF. The Terranova® 926A will automatically increase the SET POINT HIGH value to the next pressure step from the SET POINT LOW value if SET POINT LOW is adjusted greater than SET POINT HIGH and vice versa. For example, if SET POINT HIGH is set to 100 Torr and SET POINT LOW is set to 110 Torr, the SET POINT HIGH value will automatically be adjusted to 115 Torr. See Appendix 4 for relay use with inductive or capacitive load switching.

Terranova® 926A set point pressure display resolution is as follows:

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

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

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	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	Analog Output		See **Analog Output**
14	N/A	N/A	N/A
15	N/A	N/A	N/A

Table 1 INPUT/OUTPUT port pin configuration

Serial Communication

The INPUT/OUTPUT 15-pin D-sub port allows the user to remotely query the Terranova® 926A 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® 926A 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. Query applies to both pressure gauges regardless of which gauge is selected on the control unit display. Table 2 lists the characters used by the Terranova® 926A to return unit parameters.

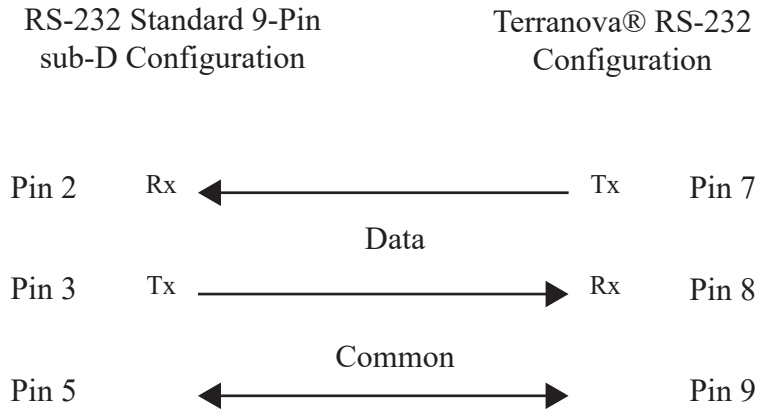

Figure 4 Terranova® 926A RS-232 pin configuration

The Terranova® 926A outputs pressure values in the following scientific notation format:

AeB XeY

in which A and X are the significand and B and Y are the exponent. When character p is transmitted to the unit, A nd B values correspond to GAUGE 1; X and Y values correspond to Gauge 2. The control unit also utilizes the same format to output set point pressure values. However, two digits are appended to the output.

AeB XeY R G

in which R indicates the set point relay state and G indicates the pressure gauge to which the set point applies. If the relay is active, R = 1; otherwise, R = 0. G = 1 corresponds to GAUGE 1 and G = 2 corresponds to GAUGE 2. When character 1 or 2 is transmitted to the control unit, pressure values correspond to SET POINT HIGH and SET POINT LOW, respectively.

Depending on selected unit, output values are either in torr or millibar

Character	Query	Output Format	Notes
1	SET POINT 1 value	AeB XeY R G	ASCII value 49
2	SET POINT 2 value	AeB XeY R G	ASCII value 50
g	Gas response curve	Air, Argon	ASCII value 103
p	Pressure reading	AeB XeY	ASCII value 112
u	Pressure units	Torr/mBar	ASCII value 117
v	Model number; Software version	926; N.NN	ASCII value 118
x	Gauge curve	275, CEP	ASCII value 120

Table 2 Serial Communication query characters

Examples	
GAUGE 1 pressure: 2.4 mTorr GAUGE 2 pressure: HI Output:	p 2.4e-3 HI
GAUGE 1 pressure: LO GAUGE 2 pressure: OFF Output:	p LO OFF
SET POINT 1 is assigned to GAUGE 1 (Relay ON) SET POINT 1 HIGH pressure: 60 mTorr SET POINT 2 LOW pressure: 57 mTorr Output:	 1 60.0e-3 57.0e-3 1 1
SET POINT 2 is assigned to GAUGE 2 (Relay OFF) SET POINT 2 HIGH pressure: OFF SET POINT 2 LOW pressure: OFF Output:	 2 0.0e-3 0.0e-3 0 2

Analog Output

The Terranova® 926A 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 values correspond to approximately 4.00 V. See Table 1 for pin configuration.

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

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

where P is the pressure reading in mTorr (or µbar) and V is the analog output voltage in volts. For example, if P is equal to 10.0 mTorr, V (rounded to nearest hundredth) is equal to 1.50 V. Table 3 lists sample analog output and corresponding pressure values.

Analog Output [V]	Pressure
0.00	LO/P ≤ 0 mTorr
0.50	0.10 mTorr
1.00	1.0 mTorr
1.50	10.0 mTorr
2.00	100 mTorr
2.50	1 Torr
3.00	10 Torr
3.50	100 Torr
4.00	OFF/HI

Table 3 Analog Output and calculated pressure values

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

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

where V is the analog output in volts and P is pressure in mTorr (or µbar). For example, if V is equal to 2.50 V, P (rounded to the nearest one) is 1.00 Torr (or 1.00 mbar).

Source impedance for analog output is 1 kΩ

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 input voltage	Verify AC voltage; if unit fails, contact Duniway Stockroom
Display is dim and reads incorrect pressure values	Incorrect AC input voltage	Verify AC voltage; if unit fails, contact Duniway Stockroom
Incorrect VAC/ATM values	Faulty pressure gauge	Replace pressure gauge

Error Code	Description
E01	Illegal operation
E02	Parameter at limit
E03	Timeout during Setup Mode
E11	ZERO adjustment not allowed at current pressure
E12	ATMOS 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® 926A 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

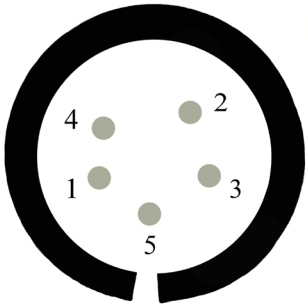

Figure 5 Granville-Phillips 275 Convectron® gauge pin configuration

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]

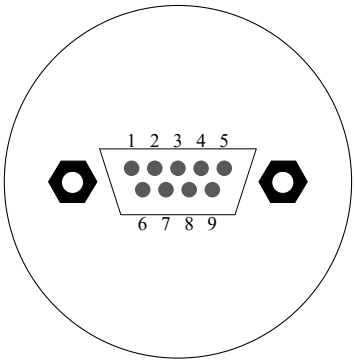

Figure 6 MKS/HPS Series 317 gauge pin configuration

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 (e.g. 20 °C). [2]

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

1. Brooks Automation, Inc. 'Granville-Phillips® Series 475 Convectron® 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® 926A contains two Type F, regular (or slow-blow) 1 A fuses. As shown in Figure 6, both fuses are held in the fuse assembly located on the back panel of the unit.

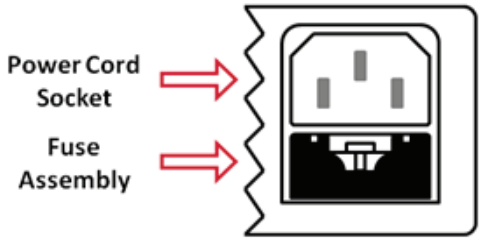

Figure 6 MKS/HPS Series 317 gauge & pin layout

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”

The following is a list of suggested replacement fuses:

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

Legacy Terranova® 926

The legacy Terranova® 926 model has been discontinued and replaced by the Terranova® 926A to increase the reading accuracy between the MKS / HPS Series 317 gauge and Granville-Phillips 275 Convectron® gauge. The added pressure gauge response curve allows for increased accuracy in pressure measurement. Although the Terranova® 926 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
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
EN 61326: 1997/A1: 1998/A2: 2002

Low Voltage Directive (73/23/EEC//93/68/EEC)
Electrical / Technical Safety Standard: EN 61010-1: 1993/A2: 1995: 2001

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

UL and CSA Listing
Safety of Electrical Equipment for Laboratory Use
Conforms to UL61010A-1, Issued 2002/01/30
Certified to CAN/CSA C22.2 No. 1010.1-92, 97

Appendix 1 Terranova® 926A 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 gauge[2**]	1/4" Female VCR
CVT-275-133	Duniway Convection-enhanced Pirani gauge[2**]	1/8" Male NPT
CVT-275-KF25	Duniway Convection-enhanced Pirani gauge[2**]	KF25
CVT-275-VCR-4	Duniway Convection-enhanced Pirani gauge[2**]	Mini Conflat
CEP-HPS-SH	MKS/HPS Series 317 Shielded Convection-enhanced Pirani gauge[3**]	1/8" Male NPT
CEP-HPS-KF16SH	MKS/HPS Series 317 Shielded Convection-enhanced Pirani gauge[3**]	KF16

** Other fittings available upon request
1 Bakeable up to 150ºC (non-operating)
2 Compatible, plug-in replacement for Granville-Phillips 275 Convectron® gauge
3 UHV compatible materials; bakeable up to 200ºC

Appendix 2 Gauge Cable Diagrams

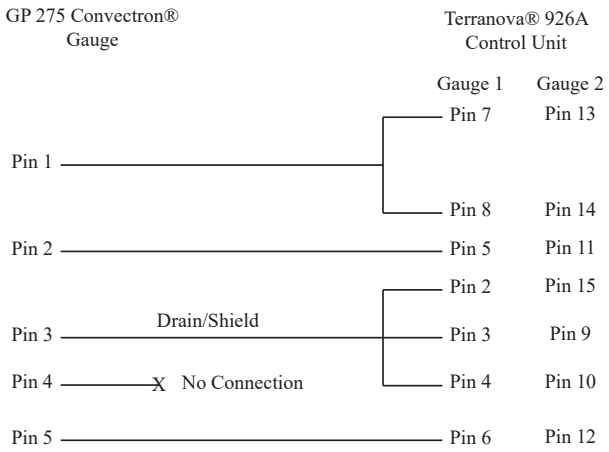

Figure 1 Terranova® 926A to Granville-Phillips 275 Convectron® gauge cable Configuration

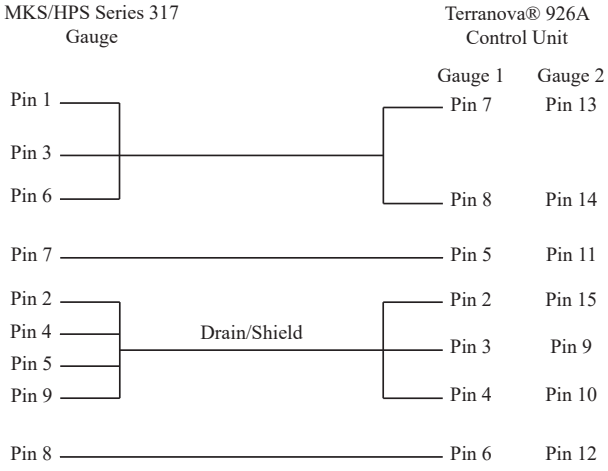

Figure 2 Terranova® 926A to MKS/HPS Series 317 gauge cable configuration

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
1×10^{-4}	1.00×10^{-4}	1.00×10^{-4}	1.00×10^{-4}	1.00×10^{-4}	1.00×10^{-4}	1.00×10^{-4}	2.00×10^{-4}	1.00×10^{-4}	1.00×10^{-4}
2×10^{-4}	1.00×10^{-4}	2.00×10^{-4}	2.00×10^{-4}	2.00 x 10-4	2.00×10^{-4}	2.00×10^{-4}	3.00×10^{-4}	1.00×10^{-4}	2.00×10^{-4}
5×10^{-4}	2.00×10^{-4}	6.00×10^{-4}	5.00×10^{-4}	7.00×10^{-4}	4.00×10^{-4}	3.00×10^{-4}	8.00×10^{-4}	3.00×10^{-4}	5.00×10^{-4}
1×10^{-3}	7.00×10^{-4}	1.10×10^{-3}	1.90×10^{-3}	1.40×10^{-4}	8.00×10^{-4}	5.00 x 10-4	1.80×10^{-3}	7.00×10^{-4}	1.00×10^{-3}
2×10^{-3}	1.30×10^{-3}	2.30×10^{-3}	2.40×10^{-3}	2.90×10^{-4}	1.60×10^{-3}	1.00×10^{-3}	3.20×10^{-3}	1.40×10^{-3}	2.00×10^{-3}
5×10^{-3}	3.30×10^{-3}	5.50×10^{-3}	6.00×10^{-3}	6.80×10^{-3}	4.00×10^{-3}	2.30×10^{-3}	7.70×10^{-3}	3.50×10^{-3}	4.90×10^{-3}
1×10^{-2}	6.50×10^{-3}	1.09×10^{-2}	1.20×10^{-2}	1.35×10^{-2}	8.00×10^{-3}	4.60×10^{-3}	1.52×10^{-2}	7.00 x 10-3	9.70×10^{-3}
2×10^{-2}	1.40×10^{-2}	2.20×10^{-2}	2.40×10^{-2}	2.70×10^{-2}	1.60×10^{-2}	9.00×10^{-3}	3.10×10^{-2}	1.40×10^{-2}	2.00×10^{-2}
5×10^{-2}	3.30×10^{-2}	5.50×10^{-2}	6.00×10^{-2}	6.90×10^{-2}	4.10×10^{-2}	2.40×10^{-2}	7.70×10^{-2}	3.50×10^{-2}	4.90×10^{-2}
1×10^{-1}	6.40×10^{-2}	1.07×10^{-1}	1.20×10^{-1}	1.36×10^{-1}	8.20×10^{-2}	4.60×10^{-2}	1.58×10^{-1}	7.00×10^{-2}	9.70×10^{-2}
2×10^{-1}	1.26×10^{-1}	2.08×10^{-1}	2.47×10^{-1}	2.59×10^{-1}	1.63×10^{-1}	8.50×10^{-2}	3.10×10^{-1}	1.40×10^{-1}	1.92×10^{-1}
5×10^{-1}	3.07×10^{-1}	4.94×10^{-1}	6.73×10^{-1}	5.82×10^{-1}	4.27×10^{-1}	2.14×10^{-1}	7.64×10^{-1}	3.53×10^{-1}	4.77×10^{-1}
1	5.90×10^{-1}	9.30×10^{-1}	1.52	1.02	9.20×10^{-1}	3.90×10^{-1}	1.56	7.30×10^{-1}	9.50×10^{-1}
2	1.12	1.68	4.02	1.62	2.16	6.80×10^{-1}	3.24	1.60	1.90
5	2.36	3.24	265.00	2.54	13.50	1.26	13.50	5.10	4.85
10	3.86	4.84		3.30		1.74	29.00	21.50	10.50
20	5.70	6.40		3.62		2.24	360.00	585.00	22.50
50	7.75	8.00		4.02		2.50	845.00		86.00
100	8.75	9.05		4.78		2.66			230.00
200	9.65	12.00		6.25		3.08			305.00
300	11.50	17.00		7.31		3.50			385.00
500	16.00	29.50		8.98		4.10			605.00
700	22.00	49.00		10.50		4.60			865.00
760	24.00	56.00		11.00		4.64			945.00
900	29.50	88.50		12.00					
1000	34.00	130.00		12.50					

Data was compiled from a number of sources and is believed to be reliable. However, if pressure readings are critical to application, user should consult a vacuum pressure gauge calibration specialist.

Appendix 4 Notes on Terranova® Set Point Relays

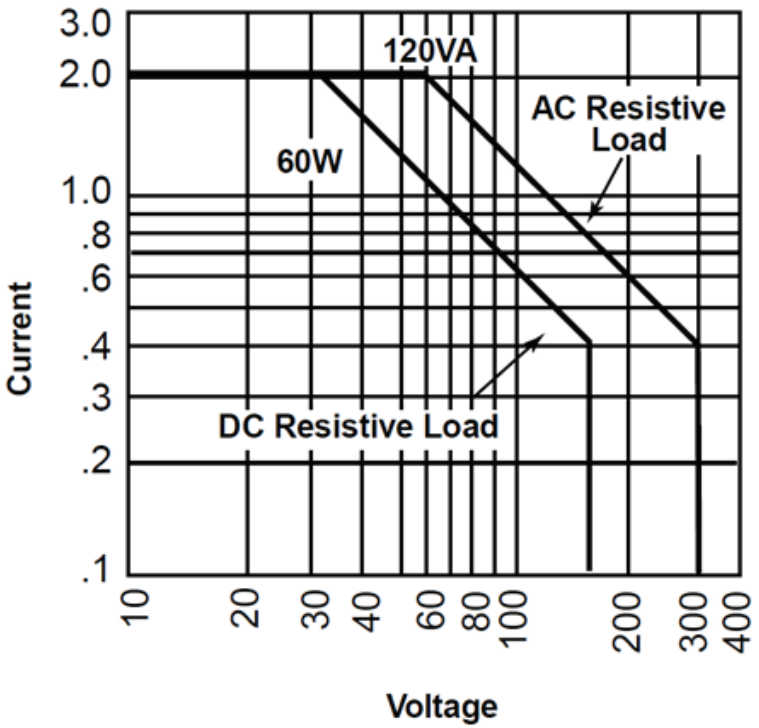

Figure 1 Heavy Duty Type AZ5 relay voltage-current relationship

The Heavy Duty Type AZ5 relay is used in the Terranova 926A 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 1, the "snubber" circuit is parallel to the high-current relay.

Appendix 4. Notes on Terranova® Set Point Relays

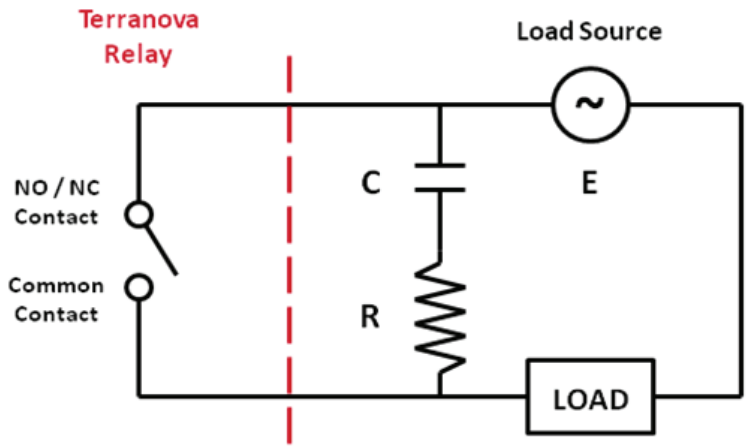

Figure 2 Example of a "snubber" circuit

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 note[1] suggests the following empirical equations:

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

$$R=E/10I(1+50/E) \quad (2),$$

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 high-current relay 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, user must take into consideration the voltage and power rating of the capacitor and resistor, respectively, to meet the requirements of the circuit. Similar protective circuits or components should be considered 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