

DUNIWAY STOCKROOM CORP.

Terranova® 809 Single Diaphragm Gauge Control Unit



Instructions Manual Revision - 0916NC

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TABLE OF CONTENTS

SPECIFICATIONS	3
ACCESSORIES	4
INTRODUCTION	6
INSTALLATION	6
Mounting the Terranova® 809	6
Connecting the Pressure Gauge	7
Setting the Display	7
OPERATION	9
Zero Adjustment	9
Span Adjustment	10
SET POINT OPERATION	10
ANALOG OUTPUT	11
TROUBLESHOOTING	12
CHANGING FUSES	12
WARRANTY	13
APPENDIX 1. TERRANOVA® 809 COMPATIBLE PRESSURE GAUGES	14
APPENDIX 2. GAUGE CABLE DIAGRAM	15
APPENDIX 3. NOTES ON TERRANOVA® SET POINT RELAYS	16

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	4 Red LEDs – 4 digits (1NNN) with decimal point selection
Pressure Units	Torr
Measuring Range	3+ pressure decades (or orders of magnitude) from full scale
Display Range	1000 Torr to 0.001 Torr
Display Resolution	0.1 % of full scale
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 2 for more details
Output Power	± 15 V DC @ 0.75 A
Temperature Range	2°C to 50°C (in operation)
Weight	1 lb / 0.5 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 **CDG-CBL-1-10** Capacitance diaphragm gauge cable (10 ft)*
(Sold separately)

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

* Custom cable lengths available upon request



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 pressure 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® 809 Single Capacitance Diaphragm Gauge Controller is designed to operate one capacitance diaphragm gauge such as the MKS 722B Baratron® Capacitance Manometer. The control unit is able to operate full scale pressure gauges between 1×10^3 Torr and 1×10^{-1} Torr with a pressure measurement output between 1×10^3 Torr to 1×10^{-3} Torr. The Terranova® 809 is set to operate standard, unheated capacitance diaphragm gauges which require a ± 15 V DC input and have a 0 V - 10 V DC output signal.

Installation

Mounting the Terranova® 809

The Terranova® 809 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.

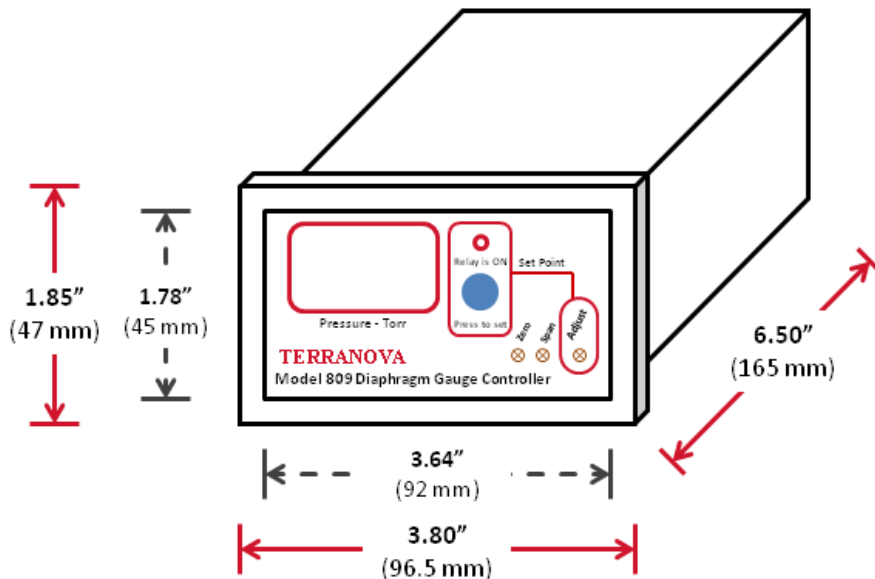


Figure 1. Terranova® 809 cutout and dimensions

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

Connecting the Pressure Gauge

The Terranova® 809 has a female 9-pin D-sub connection located on the back of the control unit labeled SENSOR to connect the pressure gauge cable (See **Figure 2**). User will require the Duniway gauge cable **CDG-CBL-1-10** to connect the Terranova® 809 to the compatible gauges listed in **Appendix 1**.

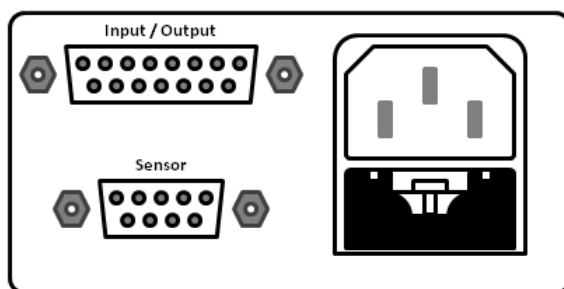


Figure 2. Terranova® 809 back view

To properly connect the Terranova® 809 to the capacitance diaphragm gauge:

1. Secure the pressure gauge cable end to the pressure gauge
2. Secure the male 9-pin D-sub connector of the cable to the SENSOR port
3. Fasten retainer screws on all cable connections

Once the pressure gauge cable is properly installed, pressure measurement can commence. 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.

Setting the Display

The Terranova® 809 outputs pressure readings using a combination of a '1' in the left-most position followed by three digits and a user-configured decimal point. Although the Terranova® 809 is able to operate a number of sensors with full scale pressure range between 1×10^3 Torr and 1×10^{-1} Torr, only those whose full scale pressure range begins with a '1' will be properly displayed (see **Table 1**). To set the correct full scale range, the user must manually configure the decimal point position of the display.

Full Scale [Torr]	Display Format	Display Resolution [Torr]
1000	1NNN	1
100	1NN.N	0.1
10	1N.NN	0.01
1	1.NNN	0.001

Table 1. Terranova® 809 display format and resolution



The Terranova® 809 may also be used to output pressure from a 100 mTorr full scale pressure gauge by using the 100 Torr full scale setting.

A red DIP switch, DIP Switch S1, is located behind the front plate of the control unit to configure the decimal point position. The decimal point position is determined by three individual ON (i.e. UP) / OFF (i.e. DOWN) switches, S1-1 to S1-3. Starting from the leftmost digit on the display, DIP Switch S1-1 sets the decimal point between the 1st and 2nd digit, DIP Switch S1-2 sets the decimal point between the 2nd and 3rd digit, and DIP Switch S1-3 sets the decimal point between the 3rd and 4th digit.

To modify the decimal point position:

1. Remove the bezel and front panel of the control unit
2. Locate the red DIP switch below the blue button
3. Set the decimal point position according to **Table 2**.

Full Scale	Switch 1	Switch 2	Switch 3
1000 Torr	OFF	OFF	OFF
100 Torr	OFF	OFF	ON
10 Torr	OFF	ON	OFF
1 Torr	ON	OFF	OFF

Table 2. Decimal point DIP switch position



Although more than one decimal point position is possible, only one position should be enabled at a time.

For example, if the Terranova® 809 will be used with a 10 Torr full scale pressure gauge, the decimal point should be set between the 2nd and 3rd digit. Thus, as shown in **Figure 3**, DIP Switch S1-2 should be set to the ON position – all other switches are set to the OFF position – to properly display pressure readings.

Full Scale: 10 Torr



Figure 3. DIP Switch S1 and decimal position

Operation

Terranova® 809 operation is almost automatic and will commence once power is introduced or restored. The control unit will output a '1' on the left-hand side of the display if:

- A. The pressure gauge is disconnected
- B. System pressure is greater than the full scale value of the sensor
- C. Pressure gauge voltage output is greater than approximately + 10.5 V DC

Random numbers during control unit start up may appear and should be dismissed.



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

Zero Adjustment

Zero adjustment is recommended when installing a new pressure gauge or to restore pressure output accuracy. Zero adjustment may be conducted through a combination of the capacitance diaphragm gauge and Terranova® 809. A trimmer labeled ZERO is available on the front panel of the control unit for zero-adjustment. Turning the trimmer to the right or left increases and decreases the pressure value, respectively. Pressure reading must be less than 0.01% of full scale to properly zero the control unit. The Terranova® 809 may also be independently zeroed from the pressure gauge. However, the pressure gauge may have to be zero-adjust once installed.

To zero-adjust the Terranova® 809 display:

1. Disconnect AC power cord from control unit
2. Disconnect the pressure gauge from the control unit
3. Create an external loop between PIN 1 and PIN 8 of the SENSOR port
4. Reconnect AC power cord to control unit
5. Use the ZERO trimmer to adjust the control unit display to read 0 Torr
6. Disconnect AC power cord from control unit
7. Remove the external loop



Availability of low set point pressure values is affected when the Terranova® 809 is not properly zero adjusted.



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

Span Adjustment

Span adjustment can be conducted through a combination of the capacitance diaphragm gauge and Terranova® 809. A trimmer labeled SPAN is available on the front panel of the control unit to adjust the upper pressure limit. Turning the trimmer to the right or left increases and decreases the pressure value, respectively. Span adjustment may be used with a 1000 Torr full scale pressure gauge for atmospheric pressure adjustment. Zero adjustment should be conducted before the atmospheric pressure adjustment.

Set Point Operation

The Terranova® 809 can be utilized for process control functions through the use of a programmable set point and corresponding relay. Set point pressure value is adjusted via the front panel; relay output can be accessed through the ACCESSORY I/O 15-pin D-sub connector port located on the back of the control unit. See **Table 3** for relay pin configuration.

The set point relay activates once the pressure reading is less than or equal to the set point pressure value minus 0.3% of full scale of the capacitance diaphragm gauge. Set point LED becomes illuminated once the relay is active. The relay will deactivate once the pressure reading is greater than or equal to the set point pressure value plus 0.3% of full scale of the capacitance diaphragm gauge. For example, if the set point value is 100 Torr for a 1000 Torr full scale pressure gauge, the relay will activate once the pressure reading is less than or equal to 97 Torr and deactivates once the pressure reading is greater than or equal to 103 Torr.

To enable set point operation, user must complete the set point enable circuit by connecting PIN 4 and PIN 13 of the ACCESSORY I/O port. Otherwise, set point operation will be disabled – set point LED will not illuminate. A trimmer labeled ADJUST is provided via the front panel to adjust the set point pressure value. Turning the trimmer to the right or left increases and decreases the pressure value, respectively. To set and / or view the pressure value, user must depress the blue button located on the front panel. See **Appendix 3** for relay use with inductive or capacitive load switching.

PIN	Function	Description	Notes
1	Set Point Relay	Normally closed (NC)	See Set Point Operation
2	Set Point Relay	Normally open (NO)	See Set Point Operation
3	Common		
4	Set Point Enable		See Set Point Operation
5	Common		
6	Voltage Output	+ 15 V DC	See NOTES
7	Voltage Output	+ 5 V DC	See NOTES
8	Common		
9	Set Point Relay	Common	See Set Point Operation
10	Common		
11	Voltage Output	- 15 V DC	See NOTES
12	Analog Output		See Analog Output
13	Set Point Enable		See Set Point Operation
14	Common		
15	Common		

Table 3. ACCESSORY INPUT / OUTPUT port pin configuration

NOTES

Pin 7, 6, 11

Nominal voltage output available for external use

Analog Output

The Terranova® 809 outputs a linear, 0 V - 10 V DC buffered analog voltage for use as a secondary method to read pressure values. 10 V represents full scale value of the pressure gauge; 0 V represents 0 Torr. Analog output can be accessed through the ACCESSORY INPUT / OUTPUT 15-pin D-sub connector port. See **Table 3** for pin configuration. **Table 4** lists sample analog output from a 1000 Torr full scale pressure gauge with a properly-adjusted pressure gauge system. For example, if pressure reading is 10.0 Torr for a 1000 Torr full scale pressure gauge, the corresponding analog output is 0.10 V. A '1' on the left-hand side of the display corresponds to approximately 13.65 V.

Displayed Pressure [Torr]	Analog Output [V]
0	0.00
10	0.10
50	0.50
100	1.00
1000	10.00

Table 4. Analog output for a 1000 Torr full scale pressure gauge



1 kΩ source impedance for analog output

Troubleshooting

Problem	Possible Cause	Diagnostic
Fuse(s) repeatedly burn out	Incorrect AC input voltage	Verify AC voltage; if unit fails, contact Duniway Stockroom
Incorrect VAC / ATM values	Faulty pressure gauge	Verify pressure gauge is operational
Incorrect VAC / ATM values	Faulty power supply	Verify unit output voltage

If the Terranova® 809 repeatedly outputs a '1' on the left-hand side of the display with the sensor connected, the protection device (i.e. resettable fuse) in series with the internal power supply may have tripped and removed power to the sensor. If the resettable fuse is open, the power supply should output a low voltage signal – output voltage range is approximately 14.5 V to 15.5 V for both the positive and negative polarity. To reset the protection device, user should remove power from the Terranova® 809 and allow the control unit to cool. If the cooling period does not resolve the issue, contact Duniway Stockroom.



Control unit may become warm during operation; this is normal

Changing Fuses

The Terranova® 809 contains two Type F, regular (or slow-blow) 1 A fuses. As shown in **Figure 4**, both fuses are held in the fuse assembly located on the back panel of the unit.

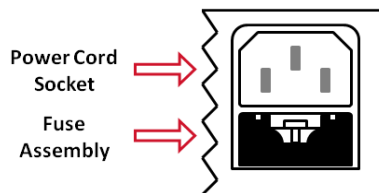


Figure 4. Terranova® 809 power module

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”

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

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.

Appendix 1. Terranova® 809 Compatible Pressure Gauges

Duniway Part No.*	Description	Pressure Range Full Scale	Fitting**
722B-1000	MKS 722B Baratron® Absolute Capacitance gauge	1000 Torr	1" OD Tube
722B-100	MKS 722B Baratron® Absolute Capacitance gauge	100 Torr	1" OD Tube
722B-10	MKS 722B Baratron® Absolute Capacitance gauge	10 Torr	1" OD Tube
722B-1	MKS 722B Baratron® Absolute Capacitance gauge	1 Torr	1" OD Tube
808-1000-NPT	Duniway Terranova® 808 Diaphragm gauge	1000 Torr	1/8" Male NPT
808-100C-NPT	Duniway Terranova® 808 Diaphragm gauge	100 Torr	1/8" Male NPT

* All pressure gauges come with a 15-pin D-sub male connection

** Other fittings available upon request

Appendix 2. Gauge Cable Diagram

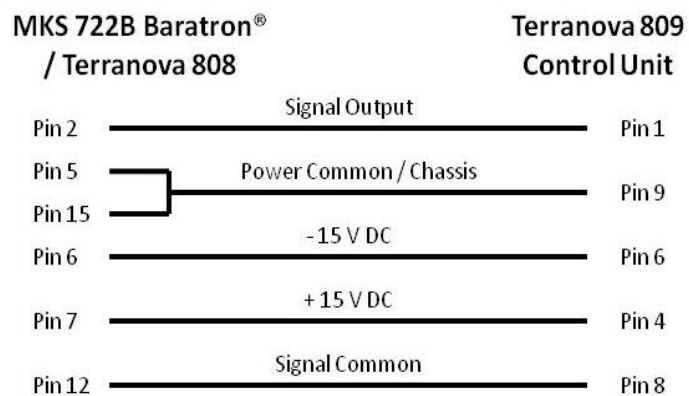


Figure _. Terranova® 809 to compatible gauge with 15-pin D-sub connector cable diagram

Appendix 3. Notes on Terranova® Set Point Relays

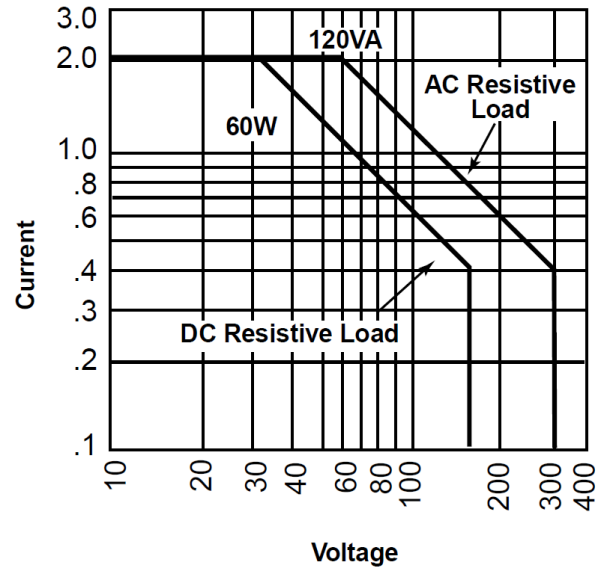


Figure 1. Heavy Duty Type AZ5 relay voltage-current relationship

The Heavy Duty Type AZ5 relay is used in the Terranova® 809 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.

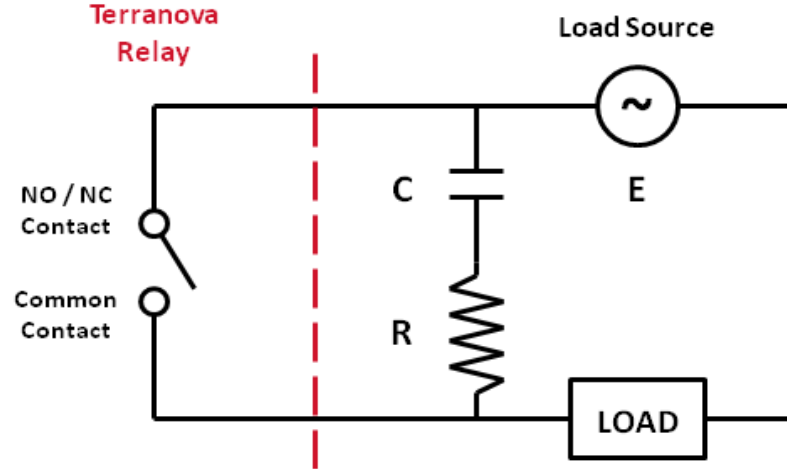


Figure 2. Example of a “snubber” circuit

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