DigiVac
Scientific Measurement & Control

Thermocouple Gauge Controller

An Economical Controller Known for Fast Response and High Stability

MUST READ MANUAL BEFORE USE

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Section 1. Overview

The DigiVac Thermocouple Gauge Contoller 6-VG-P, is a rugged, modern vacuum measurement instrument designed to make vacuum measurement easy through the use of a familiar meter movement. Electronically, it is a highly accurate digital vacuum gauge utilizing field-proven thermocouple vacuum sensor technology.

Portable

- Optional all metal case protects meter movement & electronics
- Field-proven thermocouple vacuum sensing technology

Precise

- Excellent intra-tube accuracy when utilizing SEN-DV-6M thermocouple gauge tube
- Field calibratable

Reliable

- Very simple electronics
- Easy to understand

Features:

- Movement scale with range focused on the most useful range of interest for industrial vacuum: below 500 millitorr
- International Power supply
- Designed to meet CE specifications
- 5 Volt Analog output
- 24 VDC 1 Amp Type C (common, normally open, normally closed) relay contact
- Field replaceable sensor

Options:

- 6-VG-P – Panel mount gauge that includes SEN-DV-6M sensor, sensor cable and power supply
- 6NT-VG-P – Panel mount gauge that includes sensor cable and power supply (no sensor/tube)
- 6-VG-B – Bench top gauge that includes SEN-DV-6M sensor, sensor cable and power supply
- 6NT-VG-B - Bench top gauge that includes sensor cable and power supply (no sensor/tube)

Section 2. Quick Start

A simple and intuitive gauge, yet modern implementation.

Unpack and Confirm: verify you've received everything you ordered

The vacuum instrument contains the following components:

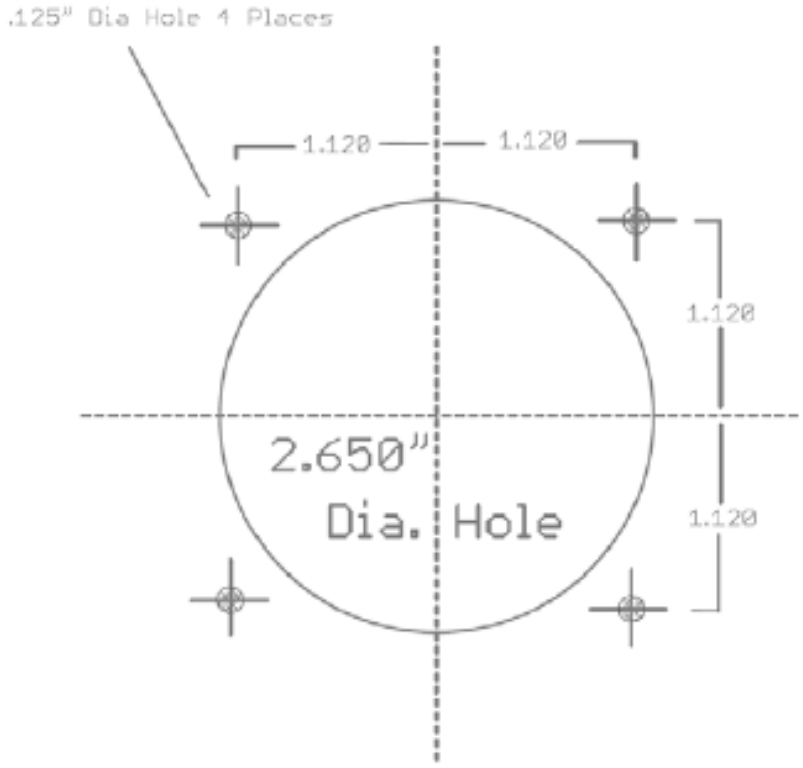
1. Vacuum gauge with an international power supply, and 10' of sensor cable with Octal connector
2. Thermocouple Vacuum Gauge Tube if ordering anything but 6NT-VG-P/6NT-VG-B
3. Quick Start guide or (this) User Manual

Easy to Use Steps:

1. Plumb the thermocouple sensor into the system to be measured, taking care to keep the stem down
2. Install the display into its table top or benchtop location
3. Connect the power and gauge tube
4. Read vacuum!

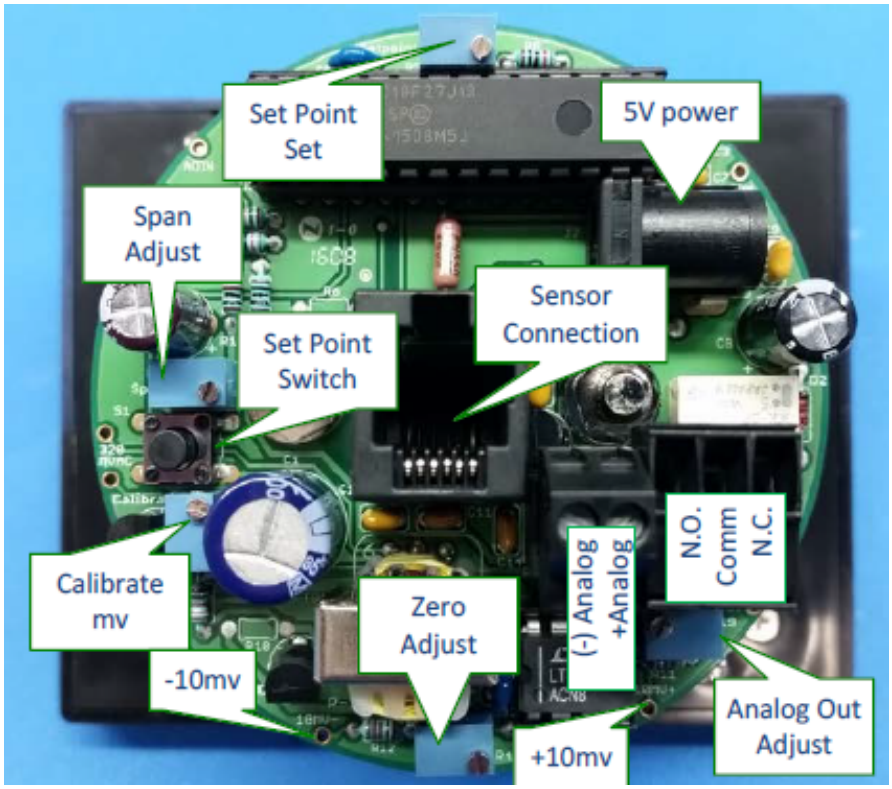
Section 3. Installation

IIf the 6-VG-P or 6NT-VG-P is purchased, it needs to be mounted. Please use the graphic below for guidance.



Section 4. Connections

The only required connections for operations are power and sensor. The connections are already made in the 6-VG-B units that come fully installed in a metal enclosure, and there is no need to disassemble the unit. The only reason you would disassemble a 6-VG-B enclosure would be to access the analog output and relay connections.



Section 5. Set Points

This gauge is equipped with a control option where a relay is activated when the gauge falls below the set point.

To set the point:

Step 1. Press the set point switch. This redirects the meter movement to be controlled by the potentiometer adjustment.

Step 2. While pressing the set point switch, adjust the set point adjustment until the meter movement indicates the vacuum level at which that you'd like the relay to activate.

Step 3. Release the switch.

The relay may turn on or off a device depending on how it is wired to the type C contacts. Below is a description of type C contacts:

1. Common - The common connection of a switch or circuit.
2. N.C. – Normally closed. This means that above the set point value there is a current path between the common and the N.C. terminal. Put another way the switch is “ON” between these 2 terminals. At the set point value and below (higher vacuum, lower pressure) the connection is open. Put another way, the switch is “OFF” between the common and the N.C. connection at higher vacuum (a lower vacuum reading).
3. N.O. – Normally open. This means that above the set point value there is no current path between the common and N.O. connection. Put another way the switch is “OFF” between these 2 terminals. When the vacuum indication goes below the set point value (higher vacuum, lower pressure) the current path closes. Put another way the switch is “ON” between the N.C. and N.O. connections at absolute vacuum readings below the set point value.

Section 6. Analog Out

This gauge is equipped with an analog voltage output to indicate the pressure level. This analog output uses voltage to simply communicate with PLCs, PCs and other control systems. Below are some sample readings:

Volts	millitorr	mbar	Pa
0.10	2	.003	0.3
0.50	10	0.13	1.3
2.20	50	.067	6.7
3.30	100	.133	13.3
4.05	200	.267	26.7
4.40	300	.400	40
4.55	400	.533	53.3

Section 7. Field Calibration

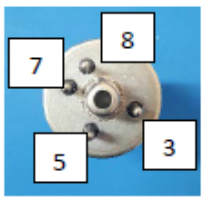
The 6-VG family of products can be calibrated in the field provided that an accurate vacuum instrument standard exists. Typically, that instrument standard should be 4x as accurate.

Calibration Procedure

1. With instrument not plugged in (not powered up), turn screw in middle of meter face (with special tool) to center needle over “DOT” on far right side of scale face
2. Plug in 5 volt A/C adapter, connect cable to SEN-DV-6M sensor. System must be < 1 millitorr. Connect voltmeter (set to DC millivolts) to bottom two test pads labeled “10mV+” and “10 mV-“. SLOWLY adjust POT R2 “CALIBRATE” so meter reads 10.0 mV
3. Raise pressure to 200 millitorr. Adjust POT R1 “SPAN” so 6-VG-P indicates 200
4. Pump system to 10 millitorr. Adjust POT R4 “ZERO” so the 6-VG-P indicates 10. Caution needed that vacuum system is holding at 10 mTorr
5. Re-check at 200 millitorr and adjust if necessary

Section 8. Troubleshooting

Here are a few trouble shooting steps:

Observation	Possible Causes
Meter stays at “•” on the right	This indicates the power off state. Verify the supply is plugged into board power receptacle, and the wall adapter is plugged in.
Meter stays near **ATM**	• Verify the system pressure is indeed below 1000 millitorr • Verify that the tube being used is a SEN-DV-6M equivalent • Verify sensor cable connected to controller and to tube • Verify SEN-DV-6M is good
Is the SEN-DV-6M sensor good? 	1. Verify 18-20ohm resistance between pins 3 and 5 2. Verify 18-20 ohm resistance between pins 3 and 7 If zero ohms or open circuit is read, the tube will need to be replaced

When I first turn the unit on, it starts near ATM, then slowly moves down	This is normal operation due to the initial heating of the filament

Section 9. Servicing and Maintenance

Gauge Tube Servicing

In many cases, a gauge tube may become fouled with oil or other foreign matter. It is often possible to restore the functionality of contaminated probes with cleaning. If the contaminant is known, the tube should be filled with a fluid that is known to be a solvent to that contaminant. As an example, ether is often effective in removing residues of some oils. Commercial carburetor cleaners are very powerful solvents and are highly effective against some contaminants.

After cleaning with solvents, the gauge tube should be completely dried or flushed with a volatile solvent to assure that it is dry prior to reinstalling it. If this is not done, contamination of the system may result.

Maintenance

Your vacuum instrument should give you many years of trouble-free service. There are no regularly scheduled maintenance intervals. If consistent accuracy is required, it is recommended that the gauge, tube, cable and power supply be returned for a yearly calibration check. For more information, please contact the DigiVac.

Notes on Calibration

The instrument is calibrated in nitrogen, which has thermal properties virtually identical to air. Other gasses will affect the readings by an amount proportional to the thermal conductivity of the gases. In most cases, the gases present in a vacuum system will be air, nitrogen, or oxygen, and no appreciable errors will occur.

Certain other gases, however, have thermal conductivity significantly greater than air and will cause the instrument to read higher than the actual amount of pressure.

Examples of such gases are water vapor, fluorocarbon refrigerants, and acetone. Conversely, other gasses have thermal conductivity significantly lower than air and will cause the instrument to read lower than actual pressure. Examples of such gases include helium, oxygen and to a lesser extent, CO_2.

When interpreting readings using gasses other than air, it should be borne in mind that the Vacuum Gauge reads absolute pressure—that is the opposite of vacuum. Thus, a lower numerical reading actually is a higher level of vacuum.

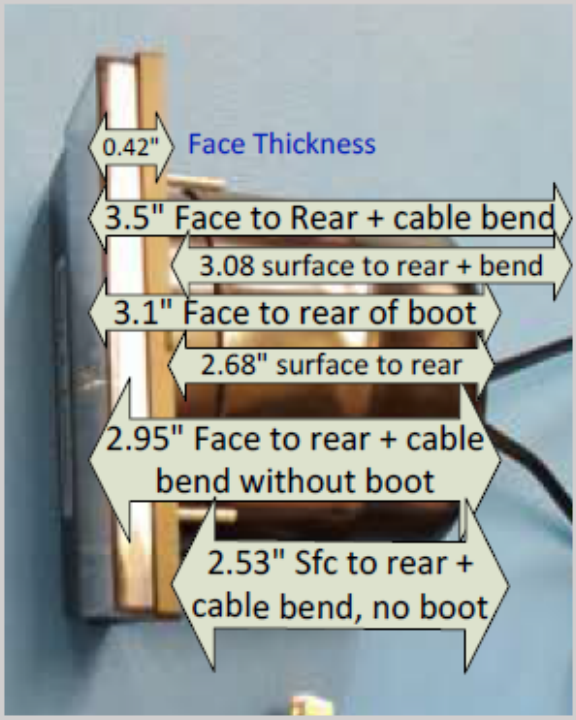
Section 10. Accuracy

Instrument Repeatable Accuracy

Range	Accuracy
1~99 millitorr	+/- 2 millitorr or 20%
100~1000 millitorr	+/- 15%

Section 11. Specifications

Time to resolve	2 seconds to decade, 20 seconds to full accuracy
Input Voltage	5.0 Volts DC external power, 110/220VAC 50-60 Hz using supplied power adapter
Maintenance Interval	1-10 years depending on use
Overall Dimensions, front panel	2.75 in high, 3.6 in wide, 2.3 inches deep
Ambient Operating range	32°F to 100°F
Relay Contacts	Type C (Normally Open, Common and Normally Closed) 24VDC, 1 Amp
Measurement Media	Clean Dry Air or Nitrogen

Certifications:	**RoHS; CE Certified, third party with SEN-DV-6M tube:** **EMC Emissions:** • **CFR 47 FCC Part 15 Subpart B Class B emissions requirements (USA)** • **EN 55011:2009:/A1:2010 Group 1 Class B ISM emissions requirements (EU)** • **EN 61000-3-2:2006/A1:2009/A2:2009 limits for harmonic current emissions (equipment input current up to and including 16A per phase)** • **EN 61000-3-3:2008: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current p to and including 16A** **EMC Emissions and Immunity:** • **EN 61326-1:2013 EMC requirements for Electrical equipment for measurement, control and laboratory use – General Use**
Face	**2.87″ high x 3.7″ wide**
Depth	

Spare Parts	**Sensor: SEN-DV-6M** **Power Supply: PS-5-1.2A-INT** **10' Sensor Cable: SC-Hast-RJ12-10**

Section 12. Understanding Torr

This instrument and many similar instruments are calibrated in microns or "milliTorr." It is appropriate to discuss what microns are and to relate microns to other measures of pressure and vacuum. Microns are not really a measure of vacuum at all, but rather of absolute pressure.

The pressure of the atmosphere is 14.696 or approximately 14.7 pounds per square inch at sea level. One TORR is an absolute pressure of one millimeter of mercury. A milliTorr is equal to one thousandth of a TORR. A MICRON is the same as a milliTorr.

This pressure is due to the weight of all of the air in the earth's atmosphere above any particular square inch. This 14.696 PSI is equivalent to the pressure produced by a mercury column of approximately 29.92 inches high or .76 meters (~ 3/4 of a yard) or 760 millimeters of mercury.

Atmospheric pressure varies greatly with altitude. It decreases approximately 1 inch of mercury per thousand feet of altitude. It also varies widely with local weather conditions. (Variations of one half inch in a single day are common.) The word “vacuum” means pressure lower than atmosphere or "suction." However, in describing negative pressure, the atmosphere is only a satisfactory reference if we are dealing with values of vacuum down to about 27 inches of mercury. Below that, it is much more useful to talk in terms of absolute pressure, starting from absolute zero. The Vacuum Gauge does just this.

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